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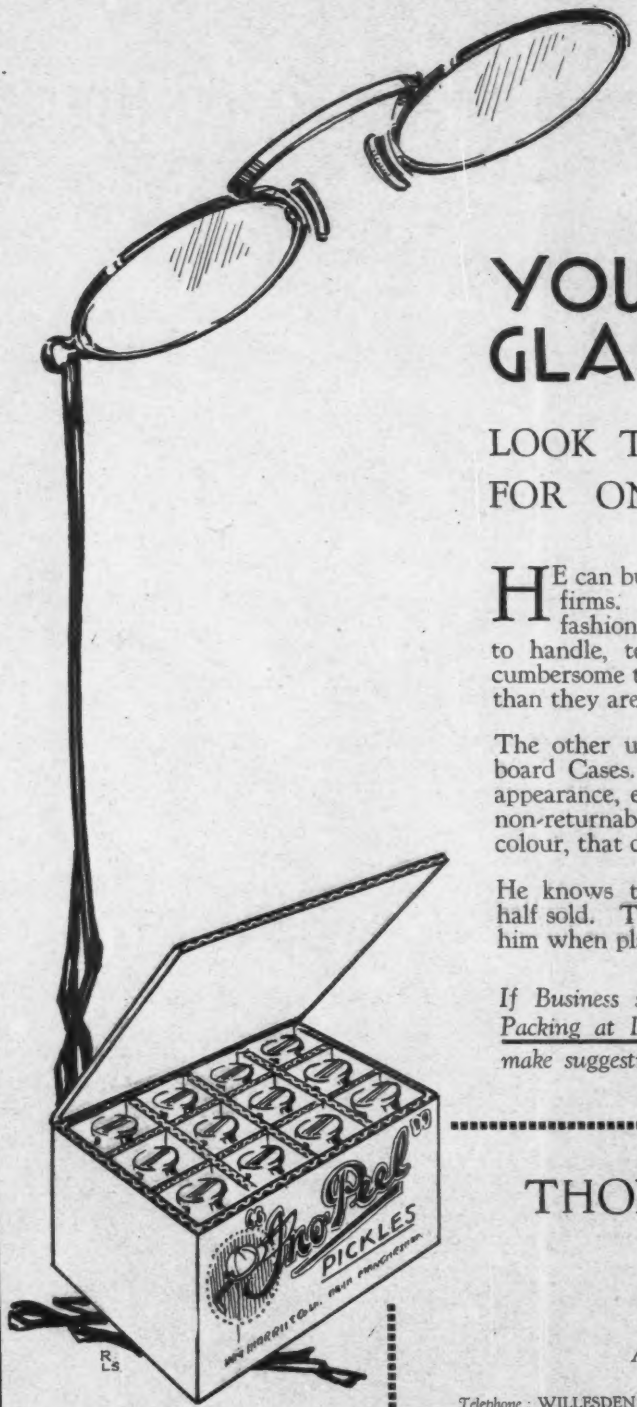

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Vol. I., No. 6

The editor will be glad to consider contributions from those engaged in the Food Industry. Articles intended for publication should be of a practical nature and accompanied by photographs or drawings whenever possible.

October, 1927

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Vitamins in Canned Foods.

A COMPREHENSIVE report by E. F. Kohman on Vitamins in Canned Foods (Bulletin No. 19—L. Revised) has recently been issued by the National Canners Association Research Laboratory, under the Directorship of W. D. Bigelow. This report gives a full discussion of the results obtained by other workers, and presents the results of over 500 laboratory tests on the effects of heat, drying, and oxidation on the stability of vitamins in various foodstuffs.

This valuable Bulletin is for the information of canners, and to guide them when they meet with misstatements about vitamins in canned foods. "A critical survey of the literature has been made in order to arrive at the most accurate conclusion possible as to the status of vitamins in canned foods."

The subject of vitamins has been "written to death." It appeals to the imagination. Hence, popular writers have found it a fertile field to exploit. Many half-truths and untruths have got into circulation, and some of these are backed by a scientific reputation. For example, statements as to the vitamin content of canned foods have been made which later evidence has disproved. "Sometimes these statements were apparently made without a very definite knowledge as to the treatment of foods in the process of canning and the effect of this treatment on the vitamins."

"These contradictions gave popular writers great leeway in their statements. The tendency has been to seize upon the most sensational and expand it to undue proportions. Special interests, not conscientious enough to be compelled to weigh all the evidence, have chosen the statements suited to their particular purpose and have exploited them. More recently, as our knowledge of the vitamins has crystallised, there is an apparent change in the scientific literature. That the vitamins are not affected by heat to the extent formerly believed is now commonly accepted."

"A consideration of all the recent experimental evidence convinces one that it is possible to select a diet, entirely of canned foods, which is complete and adequate for long continued nutrition; a diet in which all the known vitamins are represented in sufficient amounts, having such a variety of proteins that no amino-acid will be slighted, and supplying all the necessary mineral salts."

"To make such a diet as palatable, economical, and convenient as can be obtained elsewhere, is the problem of the canner. To instruct the public to choose such a diet intelligently is the duty of the nutritional expert, the food chemist and the dietician. On account of social and economic conditions the foodstuffs in many districts are restricted in variety, and it is here that canned foods afford the possibility of extending that variety by making available all the fundamental requirements at all seasons of the year."

"Canned foods have been found in general richer in Vitamin C than the home cooked foods. There is at present no experimental evidence that canned foods are less nutritious than ordinary cooked foods.

The practice of cookery is older than history, and no ill results can be traced to its practice."

We shall give further extracts from this admirable report as the opportunity presents itself.

A New Appointment.

Mr. Alfred Appleyard, M.Sc., F.I.C., Resident Director of the Campden Research Station, has been appointed General Manager of the Rhodes Fruit Farms, South Africa. These farms were started by the late Mr. Cecil Rhodes to show the possibilities of fruit growing in the Union. Fruit growing in South Africa has now become one of the most important industries in the country, and directly attributable to the pioneer work done by Cecil Rhodes.

Mr. Appleyard was formerly on the staff of the Rothamsted Experimental Station, and before joining the staff of the Long Ashton Research Station was Superintendent of the Government of India Acetone Factory at Nasik, India.

In the present issue we publish an article by Mr. Appleyard on the work which is being carried out at the Fruit and Vegetable Research Station, Campden.

New Uses of Fruit Pectin.

In the September issue of the *Fruit Products Journal*, W. A. Rooker describes the uses and possibilities of pectin as a commercial article in various foods, salads, confections, and so on. Pectin suggested itself as a possible emulsifying agent for water and oil emulsions, and research has proved it ideal for this purpose.

Essential oil emulsions, such as are used in the baking and confection industries, are being prepared with pectin. It is also being used successfully in emulsifying both castor oil and mineral oil, and by several firms in the manufacture of salad dressings.

During the past few years, several of the larger candy firms have applied pectin to their jelly and jam centred chocolates. The result has been a great improvement in quality, and has made possible a multitude of combination and novelty pieces.

Other uses are in bakers' meringue powders and in crushed fruits for soda fountains. In the latter, the increased body (viscosity) tends to prevent the fruit from rising to the top of the containers. If the cost of pectin could be cheapened it could be used advantageously in tree-spray emulsions, and as a glue or mucilage.

It is interesting to note that pectin has been used as a blood agglutinant in the treatment of intestinal hemorrhage, and it is quite possible that research would open up several important medical applications.

Lime in Butter-Making.

We have been asked by several readers for information regarding a paper presented by O. R. Overman at the Lime Symposium on the occasion of the seventy-third meeting of the American Chemical Society in April of this year. This paper was published in the May issue of the American journal, *Industrial and Engineering Chemistry*.

One of the troublesome problems arising with the development of the butter industry has been the handling of sour cream, since experience has shown that butter made from cream of high acidity develops an unpleasant flavour on standing. This problem led to a study of the use of alkaline substances for the reduction of the acidity of the cream. Attempts to pasteurise cream of high acidity resulted in the coagulation of the casein, causing the cream to become stringy or ropy. A portion of the butter fat became entrapped in the coagulum, and when such cream was churned there was a loss at times of 1 to 2 per cent. of fat in the buttermilk.

This led to the search for a way by which the acidity of the cream might be safely and satisfactorily reduced previous to pasteurisation. The outcome was the "neutralisation" process. The tendency in the United States has been to favour the use of the calcium or magnesium limes, while the British Empire uses chiefly the sodium compounds. Common practice is to use hydrated lime in suspension in water.

Hunziker and others have shown that the most satisfactory results are not secured unless the acidity of the cream is reduced to about 0·3 per cent., and also that neutralisation must not be carried much below 0·2 per cent. acidity. Hence accurate determinations of acidity must be made (see our references to hydrogen-ion control). If very sour cream is neutralised with lime, a limy flavour is likely to appear in the butter unless the neutralisation is very carefully done. Some creamery operators reduce the acidity to 0·35 to 0·4 per cent. with lime, and finish the neutralisation to the desired acidity with sodium carbonate or bicarbonate, and obtain good results.

The suspension of hydrated lime is made of convenient strength—for example, 2·4 lbs. of lime (or 2 lbs. of magnesium lime) in one gallon of suspension. After the proper amount of lime to be added to a given vat of cream is known, the method of addition must be carefully controlled. The lime mix, if of the strength given above, is thoroughly stirred to render it as nearly homogeneous as possible, strained to remove lump, and diluted with an equal volume of water. The diluted lime mix is added to the cream, which must be vigorously agitated all the while, in the form of a fine spray distributed over the surface of the cream.

Pea Cannery Wastes.

Another interesting paper presented at this symposium related to the lime treatment of pea cannery wastes. It represented a report of co-operative investigations conducted by the Wisconsin Canners Association, State Conservation Commission, and State Board of Health, in the treatment of pea

cannery wastes with lime and ferrous sulphate. Methods of disposing of these wastes, so as to avoid nuisances and stream pollution, have been sought for a number of years, but the ones so far developed have been only partially successful or of local application.

Canned Cranberries.

F. W. Morse has recently shown that the brown discoloration of cranberries preserved in tin cans is due to iron, dissolved from the interior of the can, reacting with the natural colouring matter of the fruit, and, to a less extent, with the tannin.

Milk Pasteurisation.

A Stassano plant for milk pasteurisation is under erection at the experimental dairy of the Danish Government, at Hilleroed, for practical test purposes. Pasteurisation is carried out by passing the milk through a system of very narrow tubes where it is heated to 75° C for about ten seconds, after which it is cooled to 20° in an ordinary water-cooling system. Sterilisation by this method is claimed to be more efficient than by the usual methods, and there is less change in the character of the milk.

Canning Instruction in Germany.

Dr. H. Serger, who recently contributed articles to Food Manufacture on Wrapping Papers, and who will shortly contribute another series on the subject of Tin-plate, organised a September course of instruction in the preserving of fruit and vegetables at the New Brunswick Research Station. The course was arranged to present a survey of the present position of industry as regards its development on the technical side. The practical, scientific, and domestic aspects of the subject were treated, and visits were made to a number of factories engaged in the packing and tin-plate industries. Opportunities were also given for the discussion of a variety of technical problems.

Hydrogen-ion Control.

The September issue of *Industrial and Engineering Chemistry* gives an article by W. A. Taylor, who is President of the La Motte Chemical Products Co., on hydrogen-ion control in industrial processes. Hydrogen-ion control, that is to say, the exact control of acidity and alkalinity, has been applied with good results to a large number of manufacturing processes, amongst which may be mentioned, canning, gelatine, bread, biscuits, sugar confectionery, and milk and milk products.

Many manufacturers, however, still hesitate to use this scientific method, as they feel that its application requires the services of a highly trained chemist. This is not the case. In fact, it is almost as simple to determine hydrogen-ion concentration as it is to measure temperature, and these determinations can be made practically as easily and accurately by a plant foreman as by a trained chemist.

The importance of acidity was not fully realised until the introduction of hydrogen-ion control. Older methods were by use of litmus and other test papers and by titration. Often these give erroneous and misleading results, which afford an explanation of the varying quality of many products produced under apparently uniform conditions.

Mr. Taylor describes at some length and in simple terms the colorimetric method of determining hydrogen-ion concentration. The other method, which is not discussed, is the electrometric method. The whole subject of hydrogen-ion control as it concerns the manufacture of foodstuffs will come up for adequate treatment in future issues of Food Manufacture.

SO_2 and Fruits.

The *Fruit Products Journal* reports the following conclusions reached by W. V. Cruess and A. H. El Nouty on the Preservation of Fruits in Sulphurous Acid Solutions:

1. The SO_2 content of commercially prepared maraschino cherries varies greatly. There is need for standardization of the process and of reducing the SO_2 to the minimum.

2. If the SO_2 content of canned maraschino cherries exceeds 25 mgms. per kilograms, corrosion of the container and subsequent loss is apt to ensue. Canners of fruits for salad should take this fact into account.

3. In order to preserve fruits in SO_2 solution for several months in sealed containers, the initial SO_2 content of the solution must exceed 1,500 mgms. per litre; 3,000 mgms. per litre gave good results in our tests.

4. The rate of change of SO_2 content of the fruit and storage solutions under normal storage was fairly rapid.

5. A considerable proportion of the SO_2 during storage was converted to SO_3, but more was lost by volatilization in our tests.

6. Boiling in the open and in vacuo to remove SO_2 from the fruit were compared. Open boiling was preferred for cherries and figs and in vacuo for grapes.

7. SO_2 was more rapidly removed from the fruit tissues than was $K_2S_2O_5$.

8. Salt added to the SO_2 storage solutions prevented bursting of the fruit and greatly improved the texture. Alum was also beneficial.

9. At room temperature cherries did not show much softening in SO_2 solution but at 90-100° F. softening was marked.

10. The addition of citric acid to the syrups used in preparing maraschino cherries improved the flavour and texture, and also aided greatly in sterilisation by heat.

Books Received

Baillière's Atlas of the Ox: its Anatomy and Physiology, with an Appendix on Meat Inspection. By T. G. Browne, M.R.C.V.S., Professor of Anatomy at the Veterinary College of Ireland, Dublin. Published by Messrs. Baillière, Tindall, and Cox, 8, Henrietta Street, Covent Garden, W.C. Pp. 30. Price 7s. 6d. net.

The publication represents a welcome addition to the well-known series of anatomical and other atlases published by Messrs. Baillière, Tindall and Cox. The text is by Professor Browne, of the Dublin Veterinary College, an authority who needs no introduction to agriculturists and veterinarians on either side of the Irish Sea. There are eleven pages of original anatomical and other plates by Dr. George Dupey, M.D., and in addition the contents include short chapters on the Skeleton of the Ox, Blood Circulation, Nervous System, Internal Organs, and Reproductive System, etc., in which anatomical and physiological facts are neatly blended to make interesting reading. An additional feature is the chapter on Diseases and Meat Inspection, together with plates showing the various butcher's joints.

This work is intended primarily for veterinary and agricultural students, especially those veterinarians studying meat inspection. The thirty pages of text are crammed with interesting facts, written in simple language, and will be a useful addition to the libraries of all who are engaged in the production of human food from animal flesh, and who are desirous of becoming better acquainted with facts concerning their "raw material."

The whole work reflects creditably upon author and publishers, and is cheap at the price.

D. J. ANTHONY, M.R.C.V.S.

The Home Preservation of Fruit and Vegetables. By Margaret J. M. Watson, late Demonstrator in Food Preservation, Bristol University Research Station, Campden. Published by Oxford University Press. London: Humphrey Milford, 1926. Pp. 139.

This useful little handbook is compiled by a lady who holds a diploma of the Edinburgh School of Cookery and Domestic Science, and a certificate in applied science of the King's College for Women, London.

The book was written especially for all those interested in the conservation of home-grown fruit and vegetables, and is based on the Courses of Instruction given at the Campden Research Station.

It is a thoroughly practical treatise, and is written in a clear, concise manner, so that the instructions can be followed with the minimum difficulty. It opens with a general discussion on the need for preservation. "Considerations of good sense, of health, and of economy would seem to condemn such a squandering of our national foodstuffs, and to call for the use of methods of preserving surplus supplies. Although many of these methods are simple and can be readily carried out in the home, neither the knowledge nor the practice of them is widespread."

Instructions are given in the bottling and canning of fruit; the drying of fruit, vegetables and herbs; the theory of jam-making; the preparation of fruit jellies, fruit butters and cheeses, marmalade, fruit juices, fruit syrups, and crystallised glacé and candied fruits.

Forthcoming Articles

Bacteria and the Canning Industry, II.—Condensed Milks.—R. F. Hunwicke.
Food Impurities.—H. R. Jensen.
Tin Plate in the Canning Industry.—H. Serger.
The Manufacture of Mixed Pickles.—E. Jacobsen.
Food Factory Costing.—C. E. Searle.
The Candying of Fruit.—W. V. Cruess.
Fish Curing.—W. E. Gibbs.
Methods for Improving Bakery Practice.—H. Lüthje.
Margarine Manufacture.—Paul Arup.
Fruit Juice Powder.—H. Lüthje.
Experiments of Interest to Canners.—W. V. Cruess and J. Parcell.

Research in the Canning Industry

By E. H. CALLOW, B.Sc., Ph.D., A.I.C.

The canning industry was founded as the direct result of scientific research, and its development within recent years has also been to a large extent due to laboratory work. In America, the National Canners Association has developed a vigorous research programme, which has yielded results of great commercial importance. The possibilities of the future development of the canning industry are only dimly realised, but it is probably safe to say that refrigeration will be the only serious rival to this method of food preservation.

IT IS to France that we owe our knowledge of the facts that are most fundamental to the industry of canning. A Frenchman, Nicholas Appert, devised the actual technique of canning, and another Frenchman, Pasteur, discovered the nature of fermentation, putrefaction, etc., and thus enabled us to visualise the conditions necessary for the success of the canning process. Appert, the pioneer of canning, was born at Chalons-sur-Marne in 1750. He was a man of great determination, perseverance, and patience. All his life he had worked and experimented with foodstuffs so that in 1795, when the French Government offered a prize of 12,000 francs for an improved method of preserving food, it was natural that Appert should turn his attention to the solution of this problem. Considering the state of affairs at the time (bacteria had not been discovered, and chemistry was still in its infancy), it is remarkable that the method of canning was invented; there is no doubt that the invention must have been preceded by painstaking and laborious research.

Appert soon found that food could be preserved by heating it in a closed vessel. Failures did not deter him; they stimulated him to inquire into the cause of failure, and thus prevent further errors. He himself said: "This method is not an empty theory; it is the fruit of my vigils, of my meditations, of research, and of numerous experiments, the results of which, after ten years, have produced such wonder that, notwithstanding the evidence acquired from the repeated use of preserved edibles, for two, three, and six years, many persons still do not believe in it." Appert not only discovered the principle of canning, but he also carefully worked out the details of its application to numerous foodstuffs. At first he used glass bottles with cork stoppers. He devised a new type of bottle, and had all his corks specially made of three or more layers of selected material with the pores running horizontally, for he realised that if the pores ran vertically air might gain access to the jars and cause the cooked foodstuffs to decompose. Without any knowledge of bacteriology, this ingenious investigator worked out the practical details of the canning process. He found that the food must be fresh and in good condition, that it must be dealt with rapidly, and that great care must be taken at every stage. He also realised that the foodstuff must be put into a container which could be hermetically sealed when the cooking was finished. With regard to the time required for cooking, he found that it varied with the size of the container, and with the nature of the food to be preserved, its state of maturity, the conditions under which it had been grown, etc. Such was the success of his methods that he won the prize of 12,000 francs. It is typical of his character that he used the prize money for extending the scope of his experimental work, and for placing his business on a firm foundation.

In 1810 the first edition of *Le Livre de tous les Menages, ou l'Art de Conserver, pendant plusieurs années, toutes les Substances Animales et Vegetales* was published. In this book Appert gives explicit directions for the application of his methods to many foodstuffs. It was a monumental piece of work, but Nicholas Appert was not the kind of man to be easily content, and he still continued his investigations. When the news of his methods arrived in England, a company was formed to exploit the new invention. This company introduced the use of tin cans to replace the easily broken glass bottles. Appert at once saw the advantages of this innovation and adopted it in his own factory. With characteristic thoroughness he manufactured his own tin-plate, because he realised the importance of using only a very high grade of tin-plate for his cans.

All this and much more Nicholas Appert achieved without apparatus, as we conceive it to-day, and without that flood of illumination which the work of Pasteur was destined to throw on the subject of food preservation. When we remember that before Appert's time the usual methods of preserving food were drying or salt curing, and these dried foods afforded sailors and soldiers no protection against the dreaded disease of scurvy, we begin to realise the full significance of the title of "Bienfaiteur de l'Humanité" which was bestowed upon him by his countrymen.

American Research

After Appert's death in 1841, there was a period of stagnation in canning research. The next important development took place quite recently. In 1913 the National Canners Association (of America) began to carry out research on canning, under the able direction of Dr. Bigelow. This research laboratory has already tackled many of the problems which confront the canner, and deservedly enjoys international fame in the canning industry.

Sterilisation

The principles of sterilisation are of the utmost importance in the canning industry. In the process of canning, food is placed in a container and to some extent sterilised by heat, and incidentally all air is

removed. The container is hermetically sealed in order to prevent reinfection by bacteria and access of air. Bacteriologists have found that for complete sterilisation it is necessary to heat to 250° F. If this heat standard were used for canned foodstuffs, it would mean that the material in the centre of the can would have to be kept at this temperature for some time before heating was discontinued. A great many foodstuffs would, of course, be completely spoilt by exposure to such very high temperatures. For several reasons, chiefly because of the extra expense involved in the use of higher temperatures, there is a tendency among canners to use the lowest possible temperature for sterilisation, or processing, as it is called in the industry. This can only be done safely if the chief factors involved are known. The American workers have already done much towards the solution of this problem.

Micro-organisms are, of course, always present in the foodstuffs that are used for canning, and the best method of processing any particular commodity will to some extent depend on the particular type of organism that is present. Bacteriological research has, therefore, been undertaken, and a careful study has been made of the organisms which normally occur in various foodstuffs. It is well known that when bacteria are killed by heat, two factors are involved—viz., the time of exposure to a given temperature, and the temperature itself. A prolonged heating at a certain temperature may be necessary in order to kill a certain type of organism, whereas if a higher temperature is used a shorter period of heating is sufficient. The American workers have found that there is a simple mathematical relation between time and temperature in this process of sterilisation by heat.

Heat Penetration

Even if we knew the time factor and temperature necessary to kill each particular type of micro-organism that is encountered in each canned foodstuff, we should still not be able to carry out the process of canning satisfactorily unless we also possessed another important series of experimental results. This necessary information concerns the rate of heat penetration through the contents of the can during processing. Investigators in the research laboratory of the American Canners have carried out a vast amount of work on this point. Thermocouples were employed for all measurements of temperature so that observations of temperature changes could be carried out at a reasonable distance from the retorts. As data accumulated, the following facts emerged: The time required for the centre of a can to attain a given temperature depends upon the size of the can and the consistency of the contents. In the case of cylindrical cans, in which the length is greater than the diameter, the time varies as the square of the radius, provided, of course, that the contents are similar. The manner in which the consistency of the contents affects the rate of heat penetration through cans can readily be understood from the following considerations: Whereas heat penetrates a solid substance solely by conduction, the passage of heat through a fluid depends chiefly upon convection. The first layer of fluid heated becomes less dense and rises. This rapidly induces a turbulent state in the liquid, and heat exchanges are accelerated. This process is affected by the consistency of the fluid. A viscous fluid flows less freely than a fluid like water, and hence the nearer the consistency of the contents of a can are to that of water the more rapidly will the penetration of heat occur. If the liquid is made more turbulent, the rate of heat penetration is increased. This is actually achieved by the simple expedient of rotating the cans during processing.

Botulism

The most difficult types of bacteria to kill are those which form spores. Bacteria with spores are much more resistant to heat than non-sporing bacteria, and the only certain method of killing spores is by heating to 250° F. Fortunately, however, such drastic treatment may not always be necessary. The material to be sterilised can be heated to such a point that all the bacteria are destroyed although the spores are still alive. On cooling, the bacterial spores gradually develop into the vegetative form. A second application of heat will readily kill these bacteria. In order to make sure that no spores are left, a third or even a fourth processing may be employed. *Bacillus botulinus*, the organism responsible for the dreaded disease of botulism, is a spore former. In 1921 and 1922 there were severe outbreaks of this fatal form of food poisoning in America. By this time, however, the American research workers had accumulated sufficient data to enable them to teach canners how to prevent the development of *B. Botulinus* in canned foodstuffs. The result of this was that the canners' attitude towards research changed from deep distrust and complete scepticism to almost unreasoning faith, and the research laboratory of the National Canners Association was thenceforward assured of the whole-hearted support of the American canning industry.

Tin-plate

Success in canning not only depends upon correct methods of processing but also on the employment of proper containers. An important point is that the containers must be capable of withstanding any corrosive action of the contents. As tin-plate is the commonest material used for containers, the American workers have devoted considerable attention to the problems arising from the corrosion of this material by various foods. They have experimented with different types of iron, varying thickness of tin, and special varnishes for the interior of the tin. The effect of different fruit juices on the rate of perforation during storage has also been studied. In cases where perforation is otherwise difficult to prevent, the use of cold storage has proved most beneficial. The rate of chemical changes is slowed down at low temperatures, and perforation does not occur. This slowing down of chemical changes is also beneficial in another way. Normally the colour and flavour of canned foods alters during storage. Cold stored canned foods, however, retain the colour and flavour which they had when freshly packed.

(*Continued on p.* 147.)

University of Bristol Fruit and Vegetable Preservation Research Station, Campden, Gloucestershire

By ALFRED APPLEYARD, M.Sc., F.I.C.,
Resident Director.

Campden Research Station.

THE EXIGENCIES of the climate and the incidence of disease make a nice adjustment of supplies of fresh fruit to the demand impossible. Considerable fluctuation in yield of fruit and vegetable crops is incidental to fruit and vegetable culture, and the necessity for developing fresh outlets for produce has been emphasised, especially in recent years. The demand for fruit and vegetables out of season has become thoroughly established, and various forms of preserved fruits have become common articles of food. Moreover, improved methods of marketing, involving the grading of produce, has brought the growers face to face with the problem of the profitable disposal of the low-grade material, which at present constitutes a relatively large proportion of the crop.

For these reasons, the industries associated with fruit and vegetable preservation and products are capable of making a substantial contribution to the prosperity of growers by affording important outlets for produce.

Fruit production in the United Kingdom is under a very heavy handicap as compared, for instance, with the United States, where the corresponding development of preservation and products industries has been developed on an enormous scale, by the application of scientific methods and the establishment of many research stations for the study of problems which these industries present.

The University of Bristol's Research Station at Campden is the outcome of a scheme of food production instituted by the Ministry of Agriculture during the war. It is an offshoot of the well-known Horticultural Research Station at Long Ashton, near Bristol; but whereas the parent institution is primarily concerned with the study of fruit and vegetable *production*, the one at Campden has been established to carry out research and educational work on the utilisation of fruit and vegetables, and serves as the centre for educational and advisory work on this subject.

The work of the station falls under three main heads — namely, Research, Educational, and Advisory.

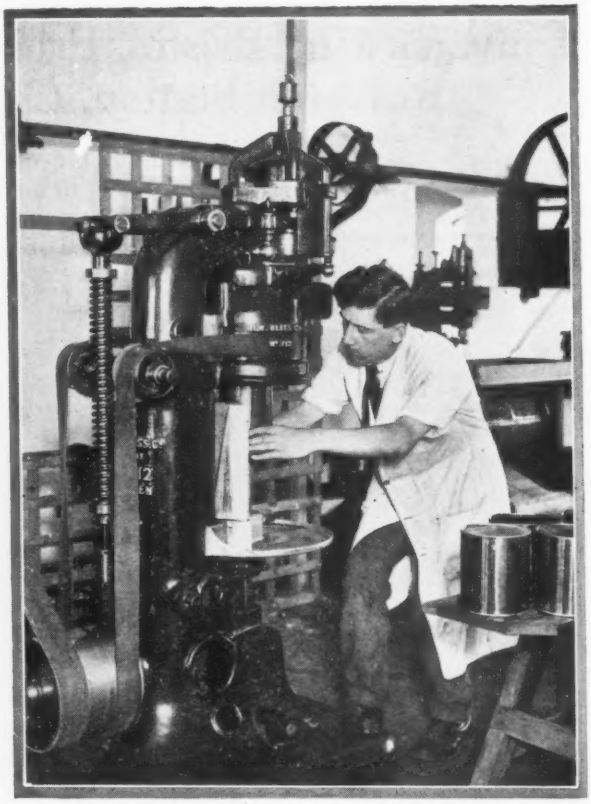
Research

Commercial scale trials of soft fruits are being carried out to determine the best temperatures and times of processing in relation to different sizes of containers, the preservation of colour, and the use of syrups. These experiments are being conducted in several commercial canneries where modern American canning machinery has been installed.

In addition, trials are being conducted in Kent at the premises of the British Fruit Packing Co., Ltd., in conjunction with an apple grading and pack-

Mr. Appleyard and Mr. Henri Benier.

Experimental Plant: Jam Pan and Autoclave.



Power-Driven Can Closing Machine.

ing scheme, on a scale sufficiently large to enable the economics of apple canning and the utilisation of low-grade apples to be studied. For this purpose, the research station has installed the most up-to-date American apple canning line which is being demonstrated to local fruit growers. The suitability of different varieties of English fruit and vegetables for canning is being determined, and the testing of lacquers for use on tinplate containers is receiving attention. This latter work is being carried out in co-operation with the manufacturers. Experiments on the preparation of plum products and of fruit juices and syrups are being made with a view to providing new outlets for English fruit.

Investigations on the biochemistry of the "brining" process for the preparation of vegetables for pickling have been undertaken, and the use of sulphur dioxide as a preservative for fruit is being studied. These and other problems associated with the general question of fruit and vegetable

Home Canning Machine.

Campden Home Kitchen.

preservation are being tackled with a view to placing at the disposal of manufacturers and others reliable methods and data, so that the rule of thumb procedure which has hitherto been a marked feature of the preserving industries may be replaced by methods which are based on sound technical data.

Educational

From a survey of the facilities for instruction in the subject of fruit and vegetable preservation in England and Wales, it is clear that the quality of instruction available is exceedingly poor. In fact, in many counties no such facilities exist, and in offering instruction in this subject at Campden, it is desired to train suitable teachers who themselves will go out amongst country women, and show how surplus produce may be made use of and how waste may be prevented.

In view of the national ignorance of the methods of home preservation, the research station provides a course of theoretical and practical instruction in fruit and vegetable preservation. The range of teaching embraces canning, bottling, jam and jelly making, the drying of herbs and vegetables, the making of pickles and sauces, crystallised fruits, etc. Ten-day courses of instruction are given throughout the summer to domestic science teachers, members of Women's Institutes, and others interested in rural industries. A large number of extra-mural lectures and demonstrations of fruit preservation are given to Women's Institutes, and the staff of the station act as judges at county and other exhibitions.

Students' Kitchen.

Advisory

The advisory work consists in visiting canneries and jam factories to give technical advice to manufacturers with regard to plant, etc.

During the past season over six hundred inquiries appertaining to fruit and vegetable preservation have been dealt with, and the station has recently published a series of leaflets in which tested methods are set forth. These leaflets are issued to the public at a charge of one penny each, plus postage.

Active help is being rendered to various firms who have undertaken fruit canning for the first time.

In undertaking a number of investigations and furnishing reports on canning and related problems at the request of the recently formed National Food Canning Council, it is serving as the centre to which the Council looks for help on the technical side.

(*Continued from p.* 144.)

The Future of Research in the Canning Industry

Such a mass of research work has already been carried out by the American workers that it might be imagined that no more need be done. But this is by no means the case. In the canning industry there is a constant search for improved materials for containers, for new methods of sealing, and for new machinery. There is also a large and as yet unexplored field for research on the effect of the various impurities found in different water supplies on the flavour and appearance of the canned foodstuffs. Moreover, scientific control in the factory is necessary if the canning plant is to be operated successfully. This involves proper testing of the finished product in order that incipient spoilage can be detected. It is only by careful research that the technique for such an examination can be perfected. One of the most important problems that awaits solution is the development of a method of canning that will cause little or no alteration in the vitamin content of the food. At present, only a few canned foods, notably tomatoes, have a relatively high vitamin content. From the dietetic point of view this lack of vitamins in canned foodstuffs is a serious matter, but fortunately it seems highly probable that further research will provide a method of canning which has a less damaging effect on these important food factors.

The annual increase in the importation and sale of canned goods proves the growing popularity of these foods. The benefits to the consumer are many and varied. There are a great variety of foods to choose from, including many that cannot be grown or produced in this country, and they also provide many articles of food when they are out of season. They are a great boon in summer when many people have no desire for hot meals. They are a pure and safe food because the contents of each can are thoroughly sterilised. There is great economy in their use, as waste is entirely eliminated, and the housewife who keeps a supply of canned goods in her larder is always well prepared for an emergency.—*Manchester Guardian Commercial, Liverpool Supplement*, July 14th.

A Chicago boxmaking concern is installing equipment at their solid fibre factories for giving each ply of the solid fibre box a thin coating of paraffin on both sides of the ply. This gives the boxes a better finish and printing surface, and makes them more moisture proof.

The New British Food Canning Industry

By DR. STANLEY SMITH, O.B.E.

IT IS curious to reflect that whilst the production of foodstuffs has always been regarded as the greatest item of importance to mankind, yet the preservation of food has only within the past half-century become a practical proposition. "Sufficient unto the day" was, perforce, accepted as a rule in life, with the result that, until Nicolas Appert discovered the art of food preservation by hermetical sealing, it was incumbent upon mankind to remain in contact with the source of food supplies.

The canning industry, as we now know it, was founded nearly a century after Appert had published his researches. The solicitude of this great man was such that every detail of his process was given to the public. This attitude presents a striking contrast to that assumed by those who subsequently entered into the commercial exploitation of a scientific idea. The pioneers of the mass canning industry were Americans, in whose vast country the problems of supplying foodstuffs to dwellers in virgin lands, of supporting life over long periods of westward trekking and in new settlements surrounded by unbroken soil, were ever insistent and ever more pressing for solution.

It is amusing to read of the earlier race of food canners, who not more than fifty years ago "walked about as if possessed of the magical secret of preserving the goods." They locked their process rooms, excluding even the owners, and shed a glamour of mystery around every operation. A friend of mine, who is now eminent in the American canning industry, tells me that, in those days, the proprietors would sneak up in the dead of night to the loft above the process-room, bore spy-holes in the ceiling, and watch the processer at work, to see what he "put in the goods to make them keep."

There was little or no real progress made in this business until the chemist and the engineer got to work on its problems. To-day, every operation is controlled by a machine—and, I must add in justice and in fairness, that practically every machine that counts in this industry is the product of American ingenuity and enterprise. In fact, it is to the invention of machinery for the making of the cans, and for the canning of the goods, that the food preserving industries owe their position among the great trades of the world. Can factories and canneries are entirely mechanical, and their thousandfold duplication within the past twenty-five years has resulted in the creation in America of, at least, three enormous and flourishing subsidiary industries.

Sir Edgar R. Jones, the gifted organiser and leader in the British fruit canning campaign—to whose voluntary effort we owe the recent co-ordination and expansion of the industry in this country—remarked to me, with obvious reluctance: "It is painful to have to note that if an up-to-date fruit or vegetable cannery were set up in this country, then the highly specialised plant and machinery would have to be imported from America." This is true; Americans get the "big business" in this line. But one of the objects I have in penning this article is to urge British engineers to turn their attention to the wants of a rapidly growing British industry.

A second vast American industry is centred in can-making. Anybody who is scared at figures had better leave the statistics of the can-makers in America severely alone. For here we deal in *thousands of millions*. In 1925 the pack of green peas alone amounted to 432,000,000 cans, and there was a huge and varied pack of twenty-odd sorts of fruits, about twenty-five varieties of vegetables, fourteen of fish (shell and scaly), and thirty of flesh (both "white" and "red")—all to be provided for in the matter of tin containers or cans. We imported some £26,000,000 worth of these canned commodities from the States, and the question is, Why? Of course, the containers are all made on high-speed automatic machines, and these machines are made in America. You will find them all over the wide world, because our own makers (and there are a few) have lacked a home market, and have, therefore, got behind in enterprise and development. It is not everybody who cultivates the habit of "looking beyond his nose."

The industry of can-making uses tin-plate as its "raw" material. Thirty-five years ago, the production of tin-plate in the States amounted to 18,800 tons. The latest statistics disclose a production of 1,328,228 tons. This is what the development of the fruit, vegetable, fish, and meat canning industries has helped to do for the American tin-plate manufacturers. The annoying thing about it all is that with such an enormous home market at his doors, the tin-plate man in the States does not seriously trouble himself about the odd shilling per "box" when quoting in competition with ourselves in the overseas markets. Now I can assert, with authority based on extensive experience, that there is no tin-plate made anywhere in the world that can compare with that produced in South Wales. Scarcely a ton of this goes to America, but we import American tin-plate, in the form of containers, or cans and their contents, to the tune of nearly £30,000,000 a year. The position is, briefly, this: The canneries in the States require about 800,000 tons of tin-plate a year, whilst the canneries in this country have their demands satisfied by a paltry 55,000 tons a year.

It is imperative we develop the food canning industry, because our peoples' demand for canned foods is enormous. Take the fruits—there is nothing, with the exception of, say, peaches and apricots, which cannot be grown and canned in this country to perfection. We cheerfully import our requirements in peaches and apricots from America, because America is as willing to take our unsurpassed strawberries and plums, when she can get them.

Do you know those dear, old-fashioned dried peas one so frequently sees in British kitchens? The sight of them always makes me weep. It would cause an American housewife to smile. And, for other

Food and Fortune

By ROBERT WHYMPER

PART III—THE UNITED STATES

HONOLULU, THE misnamed "Pacific" outpost of the United States of America, lies a bare eleven days' steaming from Yokohama. Here is a fascinating *mélange* of East and West, worthy of more mention than I can give it in this place, for nowhere else in the world can be seen the blending of coloured with white people so well as in the Hawaian Islands. The mixing process is comparable to the making of emulsions with oil and water by means of stabilisers, the olive-skinned, Portuguese and Spaniard fusing equally well with yellow Japanese and Chinese and with white Europeans and Americans through nut-brown Polynesians. The result is startling, for, generally speaking, yellow and white do not blend well, but once a satisfactory medium has been found it seems that mixed marriages prolifically produce children of excellent type. But we must pass on to America, to San Francisco, the important and glorious gateway of the "West" that narrowly escaped Japanese discovery and occupation in the early part of the seventeenth century, and that in the twentieth is all but closed to the yellow races.

No greater contrast can be imagined than to board at Yokohama a direct boat from Japan to the United States and to step off on American soil at San Francisco. The poverty and low material standards of Japan had eaten into my bones after two years' quaking beneath the Rising Sun, admirable symbol of the Blessed Isles where the sun is always rising upon the promise of "something better" but never setting to a satisfactory conclusion. I do not hesitate a moment in declaring that I am, by long training, too dependent upon the material amenities of modern Western civilisation to live the life of a Japanese without physical suffering. But equally I am emphatic in stating that never have I been so contented in mind as I was among those charmingly happy-go-lucky, fatalistic and spiritual people who have developed to the highest degree the art of finding happiness in little things, in trivialities of nature common to prince and peasant. The contrast to Japan is America, a country of material efficiency and spiritual poverty. It is not that in the United States money carries a man or woman further than in other lands, but that more thought has been given to it, to its power, possibilities, and possession; consequently, by reason of much practice, the Americans are as great experts in turning a dollar as the Japanese a poetical epigram, the first requiring high speed and quick thinking to get the better of a neighbour, the second, time and meditation to give him pleasure.

The Japanese are interested in food, as we have seen, mainly because it is the mainstay of life, but they are finicky even about so simple a thing as rice. The Americans are also interested in their food, but chiefly through advertisements which tell them what they should and should not eat, and they are entirely undiscriminating. Exception must be made in favour of the Americans, however, where salads and fresh fruit, eggs, butter, and milk are concerned, for this produce of their land is unequalled in any part of the globe. But, generally speaking, America is a *délicatessen* country, with all that the adjective-noun conjures up to the mind—quick lunches, sandwiches, tinned goods, and snacks from the re-

(*Continued from previous page.*)

reasons, the wily Jap and the avaricious French peasant would also smile inwardly, because they grow these dreadful things especially for our market. They know we have not been wide-awake enough to grow our own peas, on land and in a climate equal and superior to those of any country in the world; and, having grown the peas, "eat what we can, and 'can' what we can't." This country is able to grow sufficient green peas for all-the-year-round consumption, and the canned pea of home growth is a delicious vegetable, whereas the dried pea of foreign source is—just the thing for pigs and asses. This year sees the sure and sound foundation of a big British pea-canning industry. The plant and machinery is mostly American, but the peas are English.

I do not propose to enter upon the question of "tinned" food in relation to the public health. There is no question to discuss, as a matter of fact, for I know of no instance of "poisoning" attributable to the employment of British canned goods. When one reads of cases where medical men attribute death to "malate of tin formed by the action of malic acid on the solder," one can visualise the horror and indignation aroused against the merchants who sold the particular brand of canned tomato in question. However, I may be permitted to ease the public mind at once, for the tomatoes, which came from Italy, were packed in a tin made by American machinery from American tin-plate, and wholly devoid of solder on its inner surfaces. So the pernicious "malate," if responsible at all, could not have emanated from the contents of the can. It was, in reality, a "Mrs. Harris" of a "malate."

The possibilities of the trade in canned goods "made in England" are vast. It is an industry which, up to now, has lacked leadership and organisation. It deals with notoriously "difficult" personages, occupied in divers industries. But, in my capacity as a humble member of the Research Committee of the National Food Canning Council, I have sat at a round table at many conferences, where farmer, fruit-grower, canner, can-maker, and tin-plate manufacturer have discussed their problems, and have actually laid the foundations of a new British industry.

frigerator. Against the refrigerator I have nothing whatever to say, for the English are far behind their American cousins in conserving foods by means of this most serviceable apparatus, and they have much yet to learn in the immediate future, faced, as they are, by anti-preservative fanatics. But, thank Heaven, the English still prefer roast beef and milk puddings more or less fresh from the cow.

Again, nowhere else in the world is such nonsense talked about foodstuffs as in America, and nowhere has advertisement such a hold upon a people. Pseudo-science, with its popular jargon of calorific values and vitamins, has as great a sway as Christian Science, the Elks Club, and the Rotarians with the Americans, who appear to believe anything or, at any rate, buy anything, including a passport to heaven, if it is vouched for by a gentleman (or lady) with a foreign-sounding name followed by a number of letters. But it has to be admitted that, on the commercial side, the food-manufacturer knows the psychology of his public, and that, by his advertising, he induces vast numbers of people to buy his much vaunted wares, which not only do the consumer no harm but actually assist him in expectation of benefit through faith. The result is that most Americans are well nourished.

An analysis of the American method of feeding reveals the true character of the nation, for, if the restaurants, lunch-counters, and light-refreshment shops are visited, the European will carry away with him the correct impression that the majority of the people are undiscriminating, restive, dissatisfied, efficient, simple, and straightforward and, therefore, gullible, democratic, yet snobbish. In a country with almost unlimited resources and powers of absorption, most of these characteristics make for good business and general prosperity among the masses, and for huge fortunes for the few. Similarly, it can be understood why *finesse* (the word so commonly thrown in the teeth of the European) is absent, that their tastes are uncultured, that they are incapable of producing creative works of the spirit in an atmosphere cloudy with materialism, and that they fly to any new craze of religion, the simplest of soul sedatives, on the slightest provocation.

The point in this free analysis that may seem curious at first is that the American is compounded of all the white nations of earth, with the Anglo-Saxon predominant, and is yet incapable of the same creative art which his blood cousins import freely, particularly from poor, miserable Europe. But creations of the spirit are more the direct outcome of a certain "nice" environment than are creations of the brain for the convenience of the body from a different environment. Food plays no unimportant part in establishing the right *milieu* for success in either case, and the *bourgeois*, or even peasant, blood running in the veins of the many cannot be ignored when considering "culture." The absence of legal alcoholic drinks has, for example, twisted morally the attitude of the American towards law and order, and a lack of appreciation of properly blended food and drink, to tickle the palate and lull the body to contentment, prevents any possible creation that the shy soul might desire to express under more suitable bodily conditions. Dancing at meal times, spreading, alas, throughout the world like an epidemic, is obviously indicative of an absence of appreciation of good food and drink. Why, then, should *restaurateurs* strive to produce a dinner for an epicure with a soul if neither palate nor soul exists? The answer is: They don't, and, if they did, the restive spirit of the American would not or could not allow the food and drink to react in cultured company or in solitude.

The attitude of the American woman towards her husband and home-life is also against sensible and proper feeding. The wife, in most cases, is a worker and a wage-earner, much as her husband is, and, after the day is done, she is not prepared to stew over a kitchen-range and prepare even a passable dinner. The result is a meal from the nearest *délicatessen* shop, or taken from a "can," if she does not join her husband at a cheap "joint" or restaurant where the food is at least more attractive to the eye if no more pleasant to a delicate palate. Personally, from a knowledge and practice of the effect of certain food and drink upon myself, I am totally unable to find inspiration of the meanest order, except to escape from present horrors, whilst or after consuming a six-layer sandwich washed down with ice-water, or hot coffee, however good they may be. It is, I suppose, largely a matter of habit, but in my old age I need anticipation and realisation, the proper environment and people, and peace of mind before I can become creative in any sense. Doubtless the American will tell me that by the same token I can never become efficient—and I should believe him, for I have lived too long to make "a god out of sardine heads," as the Japanese would say.

Merchandise Marks Act

IMPORTED OATMEAL

IT is announced that an application for an Order in Council under the above-mentioned Act, to require the marking of imported oatmeal and rolled oats and also oatmeal milled in the United Kingdom from imported oats, has been referred, for inquiry, to the Standing Committee set up under the Act by the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland, acting jointly. A further notice will be issued with regard to the date of the inquiry.

Any communications with regard to the matter should be addressed to Mr. H. J. Johns, Secretary of the Standing Committee, 10, Whitehall Place, London, S.W.1

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Some of the Research Work of the Fruit Products Laboratory, University of California

By PROFESSOR W. V. CRUESS

In previous issues we have on several occasions drawn attention to the important work carried out by Professor W. V. Cruess and his colleagues at the Fruit Products Laboratory of California. Since these references have roused considerable interest, we have obtained from Professor Cruess an account of the investigations now in progress.

Tilting Silver Lined Jelly Kettles and other Fruit Preserving Equipment in Fruit Products Laboratory, University of California.

OCCASIONALLY ONE hears the query "What is to become of America's impending increased production of fruits?" Some prominent fruit men believe that we should do everything within our power to make certain that the increase moves to market at a profit. The raisin growers have now met their problem, but there were several lean years caused by too many raisins. They have met the problem largely because their management found outlets for raisins in new forms. It is a good example of what can be done in an emergency, and a lesson to other fruit industries to prepare before over-production comes—or better still, to be so thoroughly prepared that over-production shall never come.

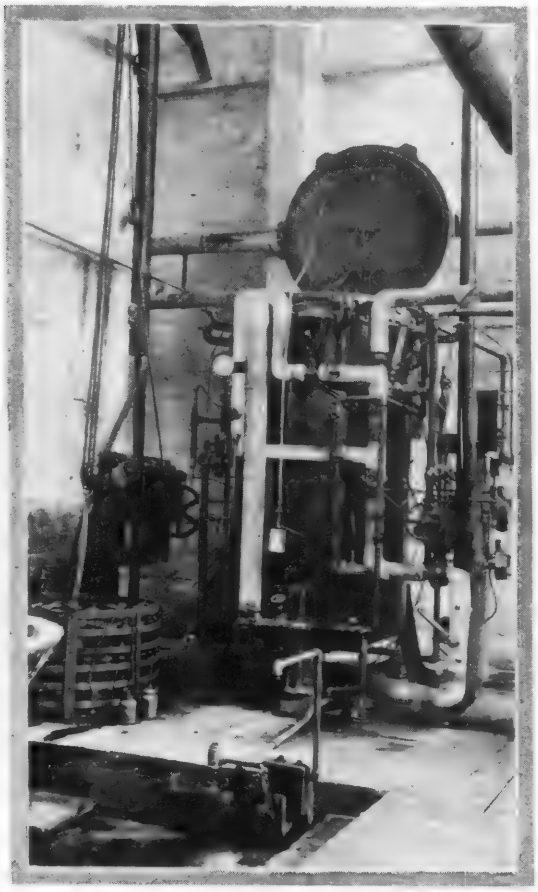
The Fruit Products Laboratory

The Fruit Products Laboratory at the University in Berkeley exists for the purpose of aiding in the marketing of California fruits by developing new uses for fruits and by improving old methods. There are three men regularly engaged in this work—A. W. Christie on dried fruits, J. H. Irish on fruit beverages, and the writer on miscellaneous fruit products.

In other states such laboratories have given most of their attention to canning, but in California the canning industry is already on a high plane of efficiency and not in crying need of our help. We work with the canning industry in developing new products, it is true, and occasionally on urgent problems, such, for example, as operation of canned vegetable sterilisers, and on olive canning.

Students are trained to become specialists in canning, preserving, fruit juices, dehydration, etc. This is one very effective means of carrying the results of our work to industry.

Considerable extension work to farmers in conventions, and in individual fruit products factories is conducted.



Experimental Cannery Retort.

But our main job is to devise and study "new stunts" for using fruits and "new wrinkles" in standard processes that will lead to the use of more fruit.

New Drinks

These are the days of synthetic beverages, non-alcoholic and otherwise. Many imitation fruit drinks are on sale—just now artificial grape beverages are very popular.

J. H. Irish reports that we consume 8,000,000,000 bottles of carbonated drinks per year, probably half of this being imitation fruit drinks. If it were real fruit there would not be enough surplus fruit in the country to make the required syrups and juice. Why do we stand for it?

Irish has demonstrated beyond all possible doubt the feasibility of producing concentrated fruit syrups of all common varieties for bottlers' use. In fact, as a result of his work, real fruit beverages are on the increase.

The new syrups are excellent not only for preparing carbonated beverages but also for home use. A blend of orange, lemon, and berry or red grape syrup may be diluted 25 or 30 to 1; one gallon makes 25-30 of fruit punch. Again, why stand for the artificially coloured and flavoured "paints" now sold for beverage use?

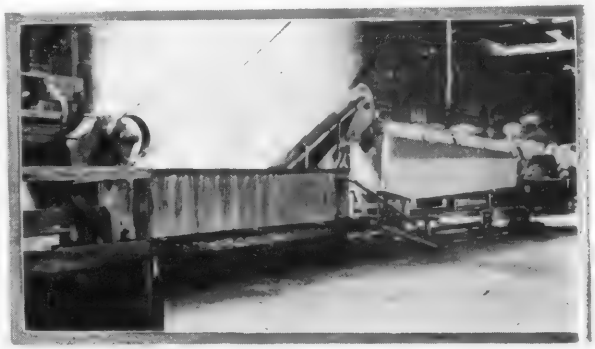
Improved Dried Fruits

Christie, of our laboratory, has greatly improved dehydrating equipment and methods for prunes and walnuts—improved quality means increased sales. The Walnut Association was so impressed with his work that it hired him from the University last season to supervise walnut dehydrating operations for its members. Satisfactory methods of dehydrating grapes, apricots, pears, berries, and peaches have also been devised—the information is available when needed.

This season extensive investigations will be made to discover means by which to limit the sulphur content of dried fruits in order that European markets may be maintained in the face of recent restrictions on sulphur content.

Fruit in Ice Cream

With the co-operation of Professor Turnbow, of the ice-cream factory on the University Farm, we are endeavouring to develop ways of putting up fruit in convenient form for the ice-cream maker, and to teach him to use fruit and plenty of it in ice-cream. We are "running on to stunts" that should very greatly increase the use of fruit in the nation's most popular dessert and make fruit ice-cream in fact as well as in name. Ice-cream unduly fortified with aniline colour and artificial flavour does not deserve the name of fruit ice-cream.



Peach Peeling Machine in a California Cannery.

Fruit in Candy

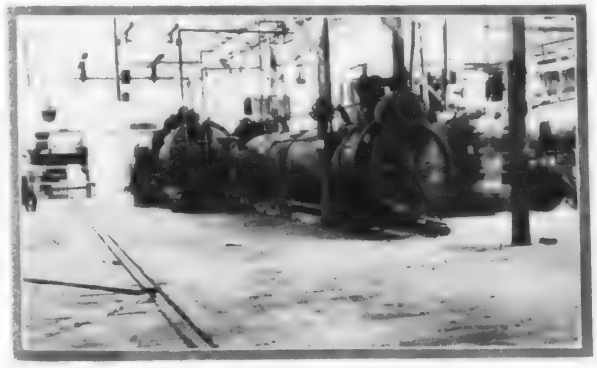
The writer has given much attention to the use of fruit in candy and made its study one of his principal objects during a recent visit to Southern Europe. Southern Europeans eat very much more fruit candy than we do. Fruit makes many standard candies better eating and far better for us.

There is an almost infinite variety of candies that can be made from and with fruits.

Students obtaining Practical Experience in Evaporation of Grapes.

A quick process of candying fruits has been devised in our laboratory which should lead to lowered costs of production. A factor limiting the use of candied fruit at present is high price.

Jellied fruit chocolate centres, cream centres mixed with preserved or dried fruits, fruit brittles, fruit fudges, and fruit nougats are examples of the products under study. America consumes over 750,000 tons of candy per year—figure out for yourself whether it would seem worth while to make 10 or 15 per cent. of this, fruit candy.



Continuous Pressure Steriliser.

Olives

The ripe olive is hard to improve upon; one of our jobs has been to find ways of using the smaller olives. An olive spread for sandwiches, for use in dressings, stews, macaroni, etc., has been devised and pronounced worthy of commercial trial. The Spanish green olive process has also been studied in order to make possible the conversion of small olives into the green processed olive for export and for sale to Latin Americans.

Utilising Surplus Canning Fruits

P. F. Nichols, of our laboratory, has given much of his time to methods of utilising surplus canning fruits in the baking, ice-cream and preserving industries. He has developed two products of commercial promise: (1) crusted canned pears, and (2) canned baked pears.

Other Investigations

Canned green vegetables are usually so heavily cooked in the can to sterilise them that much of the flavour and colour are destroyed. By addition of a small amount of citric acid to the brine, a process developed in our laboratory, the cook in the can is greatly reduced and a canned product of unimpaired flavour is obtained. Commercial size tests are now under way, and the scientific aspects of the problem have been studied as well.

The use of cull shipping plums and peaches in Placer County has been under study at the Lincoln cannery by our laboratory in co-operation with Farm Adviser McCallum and the cannery. Several very satisfactory products have been made on a small commercial scale. A thoroughly satisfactory method of extracting juice from pomegranates and converting it into a syrup suitable for fountain and home use has been developed.

One very important research problem under intensive study at present in, with, and under a grant from the Glass Container Association of America is a study of the sterilisation of glass packed fruits—especially olives. This work is being done by a graduate research assistant, Jas. Parcell.

In General

These are examples of our activities and indicate the lines of endeavour undertaken to help market California fruits. It is our belief that we can market our fruits successfully if we pay sufficient attention to developing new uses for fruits, improving standard products, and by effectively telling the consumer about it. But all of this must be done now, not five years from now—it may then be too late.

Iron in Foodstuffs

SAND IS not uncommonly found in tea; now a grocer has been prosecuted and fined for selling tea contaminated with iron filings. It is, of course, known that iron in various forms does get into tea accidentally, and large blenders instal magnets for the purpose of removal, but in many cases the apparatus is so crude, or so crudely applied, that it cannot possibly be efficient. In very many cases it appears certain that the removal of iron from tea is not conducted along efficient lines and by modern apparatus available. To mention only one outstanding fault; magnets are asked to do too much, the tea being rushed through them too quickly for all iron to be removed.

Iron, usually called "tramp" iron, is frequently found in a more or less regular percentage in quite a number of cereals, and magnets are usually used for its separation. The Rapid Magneting Machine Co., Ltd., of Birmingham, claim to make reliable apparatus designed for every purpose. They state that since 1901 they have evolved nearly twenty different types, or modification of types, and they list upwards of 300 sizes.

The most suitable type to instal depends on a number of considerations. If the apparatus is to be incorporated in a new plant, there is no difficulty in selecting the best form; but where it is to be installed between existing plant as part of a process, the first consideration is the room available. Usually head room is required. For dealing with materials such as wheat, cotton seed, linseed, cocoa beans, Soya beans, and similar foodstuffs in large bulk, the "Rapid" Type "F" Magnetic Separator is recommended. The makers guarantee an efficiency of 99 per cent., providing their instructions are followed.

The Type "F" consists of a conveyor belt. A cheaper apparatus is the ordinary Conveyor Belt Type, consisting of a magnetic pulley in conjunction with the conveyor belt. The greater the diameter of such a head pulley, the greater the efficiency with a given rate of feed. A special feature is the Current Collector Gear, which is practically dust-tight and is readily accessible for examination.

Where the iron is very finely divided, its separation becomes more difficult. In this case the "Rapid" Type "Hibb" is undoubtedly best. The magnets are stationary inside the front half of a revolving drum. The iron is held against the face of the drum, carried round to the underside, out of the magnetic field, and dropped.

The A.S.L.I.B.

The Fourth Conference of the Association of Special Libraries and Information Bureau, held at Trinity College, Cambridge, September 23-26.

LAST MINUTE touches to a somewhat neglected car, the obscure beginnings of the new Cambridge Arterial Road out of London, and the rains and deluges which assailed us on the trip prevented our attending the first session.

The reception by the Master of Trinity, and Sir Geoffrey Butler's speech must therefore go unreported in these pages.

The Conference lasted over Saturday and Sunday, the afternoons being left free. Of the many interesting papers read and discussed the majority dealt with the collection, cataloguing and indexing, and dissemination of technical information of periodicals and of books. The subject is one of great interest to those who require information on scientific or technical subjects lying outside their own sphere.

A more commercial aspect was apparent in a session ably presided over by Mr. S. J. Nightingale, of Metropolitan Vickers Electrical Co., Ltd., which dealt with Business Forecasting. Interesting papers were read by the chairman and by Major L. Urwick. The latter gentleman dealt very admirably with a paper by Mr. W. Wallace, of Rowntree's, who was unable to attend.

Among those present were:

Sir George Fordham, Sir Richard Gregory, Colonel Sir Henry G. Lyons (British Science Guild: (*a*) Science Museum; (*b*) Institute of International de Bibliographic; (*c*) Geographical Association). Sir William Schooling (James Pascall, Ltd.). W. C. Coles (Rowntree and Co.). H. Vincent Garrett ("Chemical Engineering and Chemical Catalogue"). W. Leonard Hill (FOOD MANUFACTURE). Brigadier-General Magnus Mowat (Institution of Mechanical Engineers). F. R. Richardson (Boots Pure Drug Co.). E. L. Sellars (Brunner Mond and Co., Ltd.) T. Wadsworth (British Thomson-Houston Co. Ltd.). J. G. Pritchard (Venesta, Ltd.).

The Practice of Meat Preserving and Canning

By E. W. LEWIS

The following article brings out the basic principles of meat canning, and gives an outline of the methods used in practice. The article is particularly valuable in two respects; firstly, it is backed by practical experience; and secondly, very little has been written upon the subject.

THE PRACTICE of meat preserving and canning originated during the Napoleonic Wars as an attempt to prevent food waste during military operations, the industry being placed on a commercial basis in 1821. Up to the middle of the nineteenth century the drying, salting, and smoking of meat were the chief methods of preserving, and even to-day by far the largest quantity of meat preserving is done in this manner. During the last twenty years enormous strides have been made on the technical and scientific sides of the industry, particularly in the development of machinery to prevent any contamination during the preserving and canning operations and hence minimising the liability to bacterial contamination. The development of refrigeration methods, sterilisation and hermetically sealed containers, upon which the enormous meat canning industry is built, has also received considerable attention. The application of artificial refrigeration methods and practice to the meat preserving industry provides a means of controlling temperatures of storage during all seasons of the year and is a practice which has revolutionised food distribution, materially influenced our social life, and has been the feature of a highly technical industry of great value to the community.

Principles of Meat Preserving

Meat consists of a complex system of emulsified and colloidal fat and protein dispersed in an aqueous phase, and in all methods of meat preserving and canning these facts must be kept well to the fore. Great care must be exercised in obtaining high quality meat and of the proper type. It is essential that lean cattle alone should be utilised as the raw material for meat canning purposes; fat cattle provide an inferior canned product. Investigations are

now in progress in order to breed cattle for suitable and superior food canning qualities.

The initial process of meat preserving consists in the cutting and thorough cleansing of the meat. This is done entirely by machinery and under strictly hygienic conditions. The product is then partially cooked before canning in order to destroy the more virulent bacteria; the more persistent types are destroyed during the final heating operation.

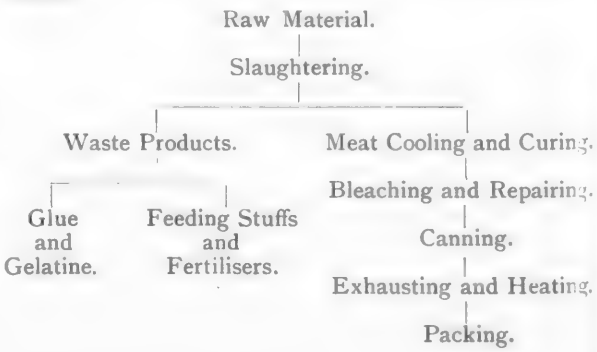
After the preliminary process the meat is placed into containers; the adjuvant, which generally consists of sterilised meat jelly, is added, and the whole is subjected to an important process termed "exhausting." By this process all air is extracted from the vicinity of the meat. Incomplete extraction of the air is highly detrimental to the "keeping" capacity of the product, and is the basic principle of the meat preserving and canning industry. Any canned meat product which does not exhibit the characteristic vacuum phenomenon on opening should be regarded with suspicion. In fact, in food inspection technology considerable importance is attached to the detection of vacuum on opening the container, and counts much in establishing whether the canned meat product is fit for human consumption.

Canned meat is sealed by means of a vacuum sealing machine, the principle of which is that the air is exhausted from the tin, the contents being automatically sealed whilst under vacuum. Upon the efficiency of this sterilising operation depends entirely the degree of resistance to spoilage of the finished product.

The final procedure in connection with meat preserving consists of what is technically known as "processing." The sealed containers of meat are heated for several hours, thereby ensuring freedom from any future bacterial decomposition. The "cooking" or sterilising process for meat products is based on the maximum heat resistance of the organisms which may be present.

Practical Methods of Canning Meats

The practical procedure for the canning and preserving of meats may be shown diagrammatically as follows:



The raw material in the form of meat used for canning must be of high quality and thoroughly clean. Organisms are so widespread throughout Nature that it is impossible to obtain the raw meat product free from bacteria, however adequate have been the means of prevention; but the number may be minimised by due attention to hygienic conditions of transport and manufacture.

The initial process of manufacture consists of meat preparation, separation of the bones, preparation of the meat stocks, and the filling into receptacles or containers. It is essential that all these operations be carried out under strictly hygienic conditions, otherwise it is impossible to produce a high-grade finished product. In the modern American factories the material is rapidly cooled without freezing, and is simultaneously subjected to superficial sterilisation in a current of sulphur dioxide. It is then rapidly heated by a blast of sterilised air at 60° C., for a time sufficient only to reheat the surface to normal temperature, whereupon the temperature of the heating agent is gradually reduced to the normal.

Rushen (English Pat. No. 180497) proposes to electrify the meat, and while in that condition it is subjected to the action of a gas or smoke. A pulsating direct current of a voltage sufficient to produce sparks in air may be used. The meat may be suspended within the treating chamber from one electrode and between two electrodes of opposite polarity, or may be suspended from conveyor chains which are connected with one electrode and move through the chamber between the electrodes of opposite polarity.

After the canning operation the meat product is heated, and conveyed by automatic devices to the exhaust chamber, where the lid is placed on the container, but not too tightly. During this treatment the contents are brought to a temperature of 100° C., when the lid is finally sealed down. The product is then sterilised by cooking or "processing." What is known as the "hole and cap" method consists of an initial heating of the product, sealing of the container whilst under vacuum, and finally "processing" as in the ordinary manner. Smith (English Pat. No. 17157, 1920) proposes sterilising canned meat products by carrying the containers on a belt conveyor through the spark gap of electrodes carrying high tension current.

The processing or retorting of canned meat products is a highly technical operation, presents many difficulties, and has an important bearing on the storage qualities of the finished product. The object in view is to sterilise the meat product without overheating, which would render the article unpalatable, unsightly, and detrimental from a saleable standpoint. What is aimed at is to cook the meat at as low a temperature and for as short a period of time as possible, with due regard to thorough heat penetration and a sufficiently high temperature to destroy all organisms.

The specific resistance to heat of organisms found in meat products varies considerably. Meyer (*Jour. Infect. Diseases*, 1922) found that the maximum survival times of *B. Botulinus* and two other anaerobes is as follows:

	Time in Minutes.		
Temperature.	*B. Botulinus.*	*B. Sporogene.*	*B. Tetani.*
Degrees Centigrade.			
120	4	—	—
115	10	—	—
110	33	12	—
105	100	45	25
100	330	150	90

The main causes of spoilage in canned meats is due to the resistance to heat of non-pathogenic organisms, their distribution and modes of spreading in nature, concerning which our knowledge is still extremely limited.

There are two "processing" methods now in vogue. The first consists of loading the tins or containers on to a travelling tier of trays, which is run into a large retort. The latter is screwed down, and the whole steam-heated under pressure until the desired cooking effect is attained. The time, pressure, and temperature vary at different factories, and are only established after long experience of the particular product manufactured. The second is a continuous method and consists of agitating the canned meat whilst it is passing through a steam-heated chamber. This latter method is finding extensive application in U.S.A.

Immediately the "processing" operation is complete the canned goods are water cooled to a temperature of about 65° C., after which they are air cooled, and the containers branded and labelled. Several authorities are of opinion that the sterilising process is of secondary importance to the successful exclusion of the air, but Leighton (*Botulism*, 1920) maintains that an efficient final sterilisation is absolutely essential in the preserving and canning of meat products.

Trade News

AN OPPORTUNITY to view a film entitled *The Master Doctor* will soon be within reach of the leading confectionery firms in the British Isles.

It is the desire of Mr. James A. King, Director of Foreign Sales Service Division of the Nulomoline Company, of New York, accompanied by Mr. R. E. Wallis, of Fredk. Boehm, Ltd., of London, to show this film to the managing directors, works superintendents, chemists, and various foremen of the confectionery departments.

The film attempts to explain the causes of fermentation in cream centres, and also suggests a remedy. It also deals with the various problems in the manufacture of confectionery, particularly of graining or crystallisation, over-inversion, and under-inversion of boiled sweets, etc.

The film represents a studied effort to show a series of charts illustrating the percentages of materials used in different types of confections. It takes approximately fifteen minutes to run off the 1,100 feet of film, and it can be shown in either a small or a large room.

Mr. King is a practical confectioner of wide experience, and is known to many of the confectioners, as this is his second trip to the British Isles, having spent eight months in Great Britain five years ago.

A stand at the Bakers' and Confectioners' Exhibition that attracted more than usual attention was that of *Bart-Newhill and Company*, of 317, High Holborn, London, W.C.1. This company had assembled an admirable display of their chocolate and confectionery machinery and moulds, which earned many flattering comments.

We note that *Mr. C. S. du Mont*, of Windsor House, Victoria Street, London, S.W.1, contributed a very instructive article on the "Vacuum Filling of Liquids" to the *Bottler and Packer* of June, 1927. Mr. du Mont, it will be recalled, represents in England the firm of Kiefer, and is a recognised authority on filling machines of every description. We understand he has devoted particular attention to jam-filling problems, and that he has in more than one instance installed plant which demonstrates beyond any doubt the very much greater efficiency of machine-filling over hand-filling for jams.

Recently we were privileged to see the new *Bliss Automatic Sanitary Can Body Maker*. This is a simple machine of substantial construction, and is capable of running at the remarkable speed of 300 cans per minute. The same company makes an automatic high-speed double-seamer for oblong and irregular shapes.

The Stonehouse Paper and Bag Mills, Ltd., have recently been favoured by articles in the *Paper Box and Bag Maker* and the *Paper Container*, describing the modern factory and the efficient service of this enterprising firm. A large proportion of the output is required for food packing, and it is stated that the papers used are made from the purest materials.

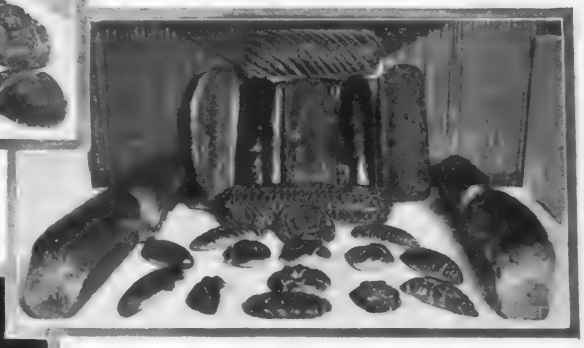
We have read with considerable interest the two useful booklets compiled by *Messrs. Johnson Matthey and Co., Ltd.*, of 76-83, Hatton Gardens, London, E.C.1. In all that concerns the precious and rarer base metals, this firm has a world-wide reputation. Moreover, it is always ready to place its unique experience and knowledge at the service of clients. These booklets should be in every chemical or technical laboratory; they contain useful information.

The Vaughan Crane Company, Ltd., of Openshaw, Manchester, have issued a new folder illustrating their cranes and runways. This firm manufactures both electrical and hand-power cranes ranging from 150 tons down to three cwts., and also makes a speciality of electric and hand-power runways for every purpose.

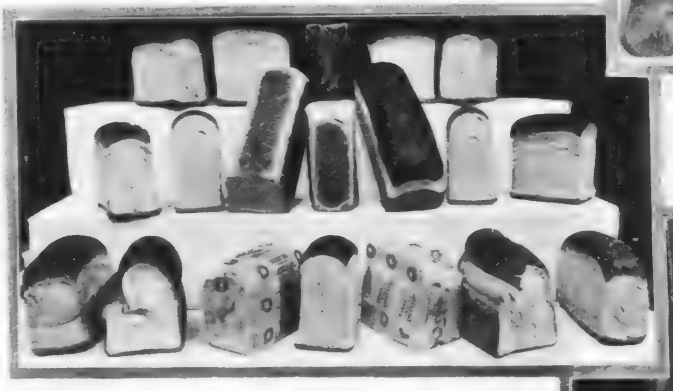
Bread from other Lands

(By Courtesy of The British Arkady Co., Ltd.)

Italian Bread, showing a Cut "Motta" Loaf.



A Few Specimens of Dutch Bread.



Loaves from Scotland.

Various Types of English Bread.

ONE OF the most interesting exhibits at the Bakers' and Confectioners' Exhibition was the collection of bread from other lands at the *Arkady* stand. We illustrate some of the types. The progressive spirit of the British Arkady Company proved itself equal to the problem of obtaining fresh samples for this display; they came over by aeroplane from their respective native lands each morning. The Scotch bread, we learned, was made on a new, short process invented by Mr. Stuart Black of the British Arkady Company, and has taken many prizes. Certainly the specimens we saw were as near perfection as one would imagine it possible to attain. Another interesting exhibit was the Welsh bread that won the South Wales championship; but we missed Irish bread altogether! The Italian "Motta" incited admiration; even the popular currant and sultana breads could not compare in attractiveness to eye and palate. Expert advice on all bread-making questions is supplied by the British Arkady Co., Ltd., Skerton Road, Old Trafford, Manchester.

Recent Advances in Cereal Chemistry

By D. W. KENT-JONES, Ph.D., F.I.C.,
Chief Chemist, Messrs. Woodlands, Ltd., Dover.

The following is taken from a thesis entitled "A Study of the Effect of Heat upon Wheat and Flour, especially in Relation to Strength," which was presented by the author to London University for a Ph.D. degree.

PART II.

Changes on Heating

In heating wheat, as described in this paper, it seems certain that such a step—*i.e.*, an increase in the degree of aggregation—is performed. Furthermore, the existence and the well-defined position of the over-treatment has been noted. Whether such a coagulation-change in the colloidal dispersion of the proteins of the flour comes about as suggested by Sörensen, is outside the main question. Certainly it is dangerous to do such strong heat treatment in the wet state, as the action is so much faster that it is difficult to control. This may be due to the acids formed increasing the speed of denaturation as well as completing the flocculation. With more or less dry heating, the denaturation is slower, is better under control, while the final stages of flocculation may not be completed until fermentation in the dough stage, with the formation of acids, is reached. In this case, the essential change takes place during heating, but the result does not appear until the acids cause the flocculation. The heating may be likened to the exposure of a camera plate, and the fermentation to the action of the developer.

Broadly, therefore, weak flours are those whose proteins are in an insufficient degree of aggregation. On the other hand, some harsh and overstrung flours make small loaves as the degree of aggregation of their proteins has proceeded too far to be broken down by normal proteolysis in fermentation.

Protein Solubility

The experiments on the protein distribution of these heated flours are not without significance, as they also indicate some increase of aggregation or coagulation, and reduction of solubility in the various solvents. Particularly interesting is the reduction of the 5 per cent. potassium sulphate soluble fraction. Woodman and Engledow (1924) examined from a chemical viewpoint the changes which occur as wheat develops. They found, amongst other things, as might have been expected, that the proteins soluble in 1 per cent. sodium chloride decreased as time went on. The proteins soluble in 1 per cent. sodium chloride will be of the same order as those soluble in 5 per cent. potassium sulphate. Woodman and Engledow's results in this case are given below.

Days from ear emergence ..	38	40	43	47	50	54	57	62	65
N. sol. in NaCl, calc. on dry basis (per cent.)	1·77	1·00	0·87	0·76	0·68	0·62	0·53	0·55	0·52

Flour made from green and immature wheat is poor, although Humphries and Biffen (1907) found no appreciable difference in the baking strength of flours milled from green and ripe wheat. In the light of general experience, however, this statement of Humphries and Biffen may be taken with reserve. Since ripening assists strength, and since ripening decreases the soluble proteins, it is not surprising that heating also strengthens and at the same time decreases the soluble protein content.

Natural Heat Coagulation

English wheat is normally weak and unsatisfactory, especially if the harvesting time is wet and comparatively cold. On the other hand, a good, hot harvest results in a much stronger flour. This strength is probably due to a partial heat coagulation occurring in the proteins, which causes increased viscosity and imbibitional powers. The heat treatment effect is in the same direction. Harvest ripening, therefore, appears to be a definite heat treatment whereby the highly dispersed colloidal proteins of poor imbibitional powers are partially coagulated. As the proteins of most wheats appear to be in an insufficient degree of aggregation, they can be greatly improved by a subsequent heat coagulation when undergoing the process of milling.

Similar views have been expressed by K. Mohs (1922), who has advocated the drying at low temperatures of poor baking quality German wheat, so that the proteins are brought nearer the "irreversible point" and farther removed from the unripe "sol" state.

If some action resulting in an increase in the state of aggregation of the proteins is necessary for the improvement of strength, the limitations of past methods of increasing strength of wheat become apparent. Humphries and Biffen (1907) have worked on the idea that strength is a Mendelian unit. Saunders (1907), on the other hand, did not consider that this was so. If the degree of heat coagulation during ripening and harvesting is a very material factor, new light may be thrown on this question. It may be possible, of course, that the improved English variety, Yeoman, which Humphries and Biffen have successfully introduced, undergoes a more extensive or rapid increase in degree of aggregation under the influence of heat than does ordinary English. It is significant that Yeoman flour has a greater imbibitional power than ordinary English, as judged by viscosity tests.

Heating has not been found to affect the racemisation of the proteins, or if it has, the effect is too small to be measured. In view of the fact that differences can only just be distinguished between weak English and very strong Manitoba, this is not surprising.

Effect of Heat on Enzymes

As might be expected, these investigations have shown that such heating does affect the enzymes of the flour, although this effect is not as important as might be thought. From the gas measurement experiments and from the maltose estimations after incubation in the manner suggested by Rumsey (1922), it does not appear that the enzymes capable of turning insoluble starch into soluble starch are much affected until overtreatment is reached. On the other hand, the enzymes which saccharify the soluble starch appear, by the Lintner method, to suffer distinct suppression. When the treatment is performed by strongly over-heating a portion of the flour and mixing this in, little or no interference with any diastatic enzymes seems to occur.

The proteolytic enzymic investigation was found to be more difficult. Neither the gelatine method nor the autolytic method of Sharp and Elmer (1924) was found to be of much service. On the other hand, the viscometric method, as autolysis proceeded, was able to distinguish the proteolytic powers of the flours with some certainty. From these results it is evident that heating, as understood here, does reduce the proteolytic activity of the flour, and part of the beneficial action is probably due to this cause. On the other hand, it seems unlikely that this suppression of proteolytic activity is anything like the main factor. There is little doubt that the increased baking value is due chiefly to the increased imbibitional power of heated proteins. The extraordinarily beneficial action of the addition of 1 per cent. of the highly overtreated flour certainly has no immediate connection with inactivation of proteolysis. Its improving action is undoubtedly due to its very great but slow power of swelling. The highly overheated flour may be likened to particles of very slow setting cement which gradually bind the material together. At the commencement of fermentation it has little, if any, effect. Then, as the dough wants to slacken and run out, this abnormally swollen nucleus knits the whole together. Usually, the longer the fermentation, the more slackening of the dough and the feeling of weakness; at the same time, the more this nucleus is swelling and stiffening the otherwise too soft dough. Such overheated flour thus becomes an "improver" of a very special and valuable nature. It contains nothing but natural flour, has little, if any, effect on the enzymic activity, and will neutralise the deleterious and excessive softening effect which often occurs at the end of fermentation.

Agricultural Treatment

From the purely English agricultural point of view, the matter may be one of great importance. Even Yeoman wheat, although an improvement on ordinary English, is not a strong wheat in the same sense as Manitoba, for example. Davidson and Shollenberger (1926) have reported that a very substantial increase in the protein content of wheat can be obtained by manuring with sodium nitrate at heading-time. If this were done with English wheat (the ordinary, and even better still with the Yeoman variety) then it might be possible to get a consistently high protein wheat. Davidson and Shollenberger found that their high protein wheat produced flour giving an extra large loaf, although Mangels (1925) found that often the quality of the gluten in the high protein wheats was inferior to that in the low protein wheats. Provided, however, an English wheat could be consistently grown with a high protein content, the quality of the gluten, if not good enough, could be rectified by heat treatment. Thus, really strong flour could be made from English grown wheat.

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Patents and Designs Acts

Application for Restoration of Lapsed Patent under Section 20.

Notice is given that Krausz Moskovits Egyesult Ipartelepek Reszvenytarsasag have made application for the restoration of the Patent granted to them for an invention entitled "Process of producing yeast" numbered 174,628 (2337 of 1922) and bearing date under the International Convention 24th day of November, 1915, which expired on 24th day of November, 1925, owing to the non-payment of the prescribed renewal fee.

Any person may give notice of Opposition to the restoration by leaving Patents Form No. 17 at the Patent Office, 25, Southampton Buildings, W.C.2. on or before 17th day of October, 1927.

Census of Production (1924)

The following particulars, extracted from the Board of Trade Journal, are given by the Third Census of Production (1924), Preliminary Reports, No. 17.

Preserved Meat, Fish, Fruit and Vegetables, Pickles and Sauces Trades

IN THE Census of 1907 the manufacture of jams and other preserved fruit was associated with that of sugar confectionery rather than, as in the 1924 Census, with other kinds of preserved foods, and the main output of preserved fruit was returned on a separate schedule from that relating to other kinds of food preserving. The general aggregates ascertained in the 1907 Census in regard to the preserved foods trades are not, therefore, directly comparable with those for the year 1924, and comparisons between the results obtained for the two years must be limited to certain classes of products the output of which appears to have been returned on schedules for these trades to a corresponding extent in each year. For this reason the statements given below in regard to production, employment, and mechanical power contain no corresponding figures in respect of the year 1907.

The following statement gives particulars of the output in 1924 of firms whose returns were made on schedules for the preserved meat, fish, fruit, and vegetables, pickles and sauces trades. The figures relate to production in Great Britain only.

The main output of vinegar and of farinaceous preparations has been returned elsewhere than on schedules for this trade (see *Board of Trade Journal*, Preliminary Reports Nos. 13 and 15 respectively), and in the case of many of the other specified classes of goods important quantities will require to be included on the summarisation of the returns made by the somewhat large number of firms whose main output consists of some other class of products. Thus, preserved meats in the form of pies, cooked meats, etc., valued at £2,114,000, were returned by manufacturers of bacon and sausages (see Preliminary Reports No. 14, 9th June, 1927), and a relatively large output of jams and other preserved fruits has been recorded in returns made by manufacturers of sugar confectionery. It is probable that the bulk of the output in Great Britain is covered by the figures given above for meat and fish paste, pickles, sauces and condiments, dried and canned vegetables, spices, baking powder, and blancmange, custard, etc., powders, but in the case of other kinds of preserved meats and of marmalade, jams and fruit jellies the figures given probably fall considerably short of the actual aggregates. It is proposed to furnish more complete figures in regard to the production of the latter class of goods when the summarisation of the returns made by the manufacturers of sugar confectionery has been completed. It is, however, of interest to note here that the total quantity of marmalade, jams, and fruit jellies made in Great Britain in 1907 by manufacturers who recorded their output on the census schedules was about 2,675,000 cwts., so that, even without taking into account the additional amounts remaining to be added as stated above, an increase of about 15 per cent. is shown. The average value per cwt. of the amounts here compared was higher by 145 per cent. in 1924 than in 1907.

Products.	1924.	
	Quantity.	*Selling Value.*
Preserved Meat in tins, glasses, etc., including Meat Extracts	*Cwts.* 171,000	£ 3,748,000
Fish, tinned :		
Weight stated	112,000	301,000
Weight not stated	—	13,000
Meat and Fish Pastes in tins or glasses	—	764,000
Other Preserved Meat (Soup, Pies, etc.)	—	304,000
Total Value—Preserved Meat and Fish, including Extracts	—	5,130,000
Pickles, Sauces and Condiments :		
Pickles :	*Cwts.*	
Weight stated	310,000	1,139,000
Weight not stated	—	213,000
Sauces and Condiments	—	2,015,000
Total Value—Pickles, Sauces and Condiments	—	3,367,000
Vegetables, dried, canned or bottled :	*Cwts.*	
Weight stated	40,000	166,000
Weight not stated	—	22,000
Spices, ground	96,000	467,000
Preserved Fruit :	*Cwts.*	
Marmalade, Jams and Fruit Jellies	3,071,000	10,603,000
Fruit preserved without sugar, tinned or bottled	58,000	219,000
Fruit in thin or thick syrup, tinned or bottled	55,000	238,000
Candied or drained Peel	137,000	496,000
Other Kinds	30,000	131,000
Preserved Fruit, not separately distinguished :		
Weight stated	21,000	79,000
Weight not stated	—	45,000
Total Value—Preserved Fruit	—	11,811,000
Jelly Squares, Powder and Crystals and Bottled Jellies (not including Fruit Jellies)	*Cwts.* —	1,262,000
Baking Powder :		
Weight stated	106,000	562,000
Weight not stated	—	72,000
Blancmange, Custard and similar Powders	—	1,422,000
Vinegar (bottled)	*Gallons.* 229,000	27,000
Farinaceous Preparations (including Farinaceous Infant and Invalid Foods	*Cwts* 86,000	310,000
Other Infant and Invalid Foods		358,000
Culinary Essences (Vanilla, Lemon, etc.)		425,000
Provisions not separately distinguished		83,000
Other Products		3,913,000
Total Value of Goods Made		29,397,000

The output in the United Kingdom of the principal kinds of goods returned on schedules for this trade in the Census of 1907 was as follows:

Products, 1907.	*Selling Value*
	£
Meat, Poultry, Game and Fish, preserved, tinned, potted or bottled (including tongues, soups, pies, etc., and extracts and essences of all kinds)	2,419,000
Pickles and Vegetables, preserved in salt or vinegar	370,000
Sauces and Condiments	648,000
Pickles and Sauces, not separately distinguished	60,000
Spices and Herbs of all kinds	342,000
Baking Powder	245,000
Blancmange Powder, Custard Powder and similar powders	317,000
Jelly Squares	107,000
Culinary Preparations and Grocers' Sundries ...	182,000
Other Products	436,000
Total value	5,126,000

Taking those products which are probably covered to about an equal extent in the two years, the value of pickles, sauces, and condiments returned on schedules for this trade was shown as £1,078,000 for the year 1907 and as £3,367,000 in 1924; for baking powder the figures are £245,000 in 1907 and £634,000 in 1924; and for blancmange powder, custard powder, and similar powders £317,000 in 1907 and £1,422,000 in 1924. For these three classes, when the advance in prices is taken into account, the figures indicate an increased output in 1924. The total value of the various kinds of preserved meats, fish and meat extracts made by firms furnishing returns on schedules for this trade was £2,419,000 in 1907 and £5,130,000 in 1924.

Exports and Imports

The quantity and value of preserved meats, fish, and meat extracts exported and imported in the year 1924 were as follows:

Kind of Goods.	*Exports, 1924.*		*Net Imports, 1924.*	
	Quantity.	*Value.*	*Quantity.*	*Value.*
	Cwts.	£	*Cwts.*	£
Tinned and Canned Meat (including Tongues)	17,000	106,000	839,000	3,018,000
Meat Extracts and Essences	14,000	361,000	53,000	602,000
Fish, Canned:				
Herrings	117,000	281,000	25,000	93,000
Other Sorts ...	14,000	51,000	1,040,000	5,671,000

The excess of the exports of canned fish over the production recorded in the Census year may be due to exports in 1924 of fish in stock at the beginning of the year, to variations in the period covered by the Returns of production while the activities of the canning establishments vary from season to season, or to the omission from the above summary of amounts produced by some establishments whose output figures in the record of exports, but whose Returns were not made on the schedule under review.

Net Output

The net output of the factories and workshops covered by the foregoing statement was £11,625,000, that sum representing the amount by which the total value of the output (£29,397,000) exceeded the cost of materials purchased and used (£17,772,000). The net output per head of persons employed was £332.

Persons Employed

The average number of persons employed during the year at the factories and workshops to which the foregoing statement of output relates was 34,980, of whom 29,105 were recorded as operatives and 5,875 as management, clerical and technical staff.

The age and sex distribution of the total number employed was as follows:

Ages.	*Males.*	*Females.*	*Total.*
Under 18 years	820	5,070	5,908
Over 18 years	11,419	17,053	28,072
Total	12,248	22,732	34,980

The highest number of operatives at work at one time during the year in these trades was 35,475 (in July) and the lowest 26,621 (in January).

Power

The total capacity of engines at the factories to which the above statement of production relates was shown as 8,871 horse-power, of which nearly 26 per cent. was in reserve or idle during the year. Motors aggregating 13,562 horse-power, driven by purchased electricity, were also returned. Slightly over 7 per cent. of the capacity of these motors was shown as in reserve or idle during the year.

The main kinds of engine power at factories were as follows:

	Horse-power.
Steam Engines, Reciprocating ...	6,432
Steam Turbines	8
Internal Combustion Engines ...	2,431
Total	8,871

The capacity of electric generators at factories, according to the motive power employed, was as shown below:

Driven by—	*Kilowatts.*
Steam Engines, Reciprocating ...	3,021
Internal Combustion Engines ...	759
Total	3,780

There were also returned electric motors of a total capacity of 3,180 horse-power driven by electricity generated by engines at the factories. Of this total capacity nearly 9 per cent. was in reserve or idle during the year.

Commercial and Legal News

(The Editor does not accept responsibility for any errors which may occur in the following notices.)

New Companies

The undermentioned particulars of New Companies recently registered are taken from the Daily Register compiled by Jordan and Sons, Ltd., Company Registration Agents, 116-118, Chancery Lane, London, W.C.2.

GROCERY PRODUCTS, LIMITED. (223891) Regd. August 19, 1927. To take over the bus. of a dealer in grocery products now cd. on by T. E. Hobson. To enter into an agmt. with the Niagara Liquid Mustard Co., Ltd. Nom. Cap.: £6,600 in 5,900 "A" shares of £1 each and 2,000 "B" shares of 1/- each.
Permt. dirs.: T. E. Hobson, 3, St. Martin's Avenue, Epsom, Surrey (chairman).
S. H. White, 4, Rostrevor Avenue, Stamford Hill, N.
Qual. of dirs., £50 shares. Remun. of dirs., £100 each per annum.

BOROBRIDGE MILLING COMPANY, LIMITED. (223884) Regd. August 19, 1927. The Old Flour Mill, Borobridge. To carry on the bus. of corn millers, corn mchts., etc. Nom. Cap.: £1,000 in £1 shares.
Dirs.: W. Maltby, The Vineries, Borobridge.
R. F. Winder, Parkfield, Newton Road, Leeds.
C. E. Winder, Riverholme, Borobridge.

SURREY COUNTY PRESERVES, LIMITED. (223944) Regd. August 22, 1927. To carry on the bus. of mnfrs. of and dlrs. in jams, jellies, marmalades, preserves, etc. Nom. Cap.: £100 in £1 shares.
Dirs.: Not named.
Remun. of dirs., as voted by the company.
Subs.: G. Huckle, J.P., Mayfield, Birkenhead Avenue, Kingston-on-Thames.
S. Boorman, J.P., Heath Farm, Send, Surrey.

PENICK & FORD, LIMITED. (224067) Regd. August 29, 1927. 15, Eastcheap, E.C.3. To carry on the bus. of mnfrs., producers, and dlrs. in all kinds of sugars, molasses and kindred products, etc. Nom. Cap.: £5,000 in £10 shares.
Dirs.: F. T. Bedford, Greens Farm, Connecticut, U.S.A.
J. B. Vanderbilt, Glen Head, New York, U.S.A.
T. G. Flaherty, 165, Broadway, New York City.
H. T. Hanwell, "Sheringham," Parkenau Avenue, Thorpe Bay.
M. E. Turner, Ashe House, Ashe, Overton, Hants.
Remun. of dirs. (except mang. dir.), as voted by the company.

WALTER ROBERTSON AND SON (1927) LIMITED. (224125) Regd. August 31, 1927. Brentford Bridge, Brentford. To take over the bus. of mnfg. confectioners cd. on at Brentford by Walter Robertson & Son, Ltd. (in liquidation). Nom Cap.: £5,500 in £1 shares.
Dirs.: P. W. Silverstone, "Stoke Lodge," 72, Church Road, Richmond.
H. Clayton, 257, Jersey Road, Osterley Park.

MEURISSE, LIMITED. (224150) Registered September 1, 1927. 3, London Wall Buildings, E.C. To take over the bus. and assets of "Chocolat Meurisse," or any part thereof, and to carry on the bus. of chocolate and confectionery mnfrs. etc. Nom. Cap.: £350,000 in £1 shares (200,000 preference and 150,000 ordinary). Minimum subsn., 7 shares.
Dirs.: To be appointed by the subs.
Qual. of dirs., £200 shares. Remun. of dirs. (except mang. dir.), £200 each per annum (chairman £50 extra).
Subs.: L. G. Brooks, 42, Dunkeld Road, Chadwell Heath.
Major W. M. Beckwith, North Lodge, Lavant, Chichester, Retd.
And five others.

E. ALDRIDGE AND COMPANY, LIMITED. (224250) Regd. September 6, 1927. To develop and turn to account the bus. of mineral water mnfrs. cd on at Southampton, Bournemouth, and elsewhere as "E. Aldridge and Company." Nom. Cap.: £4,000 in £1 shares.
Dirs.: E. D. Townsend-Rose, Little Prescotes, Brockenhurst, Hants.
H. Brickwood, address not stated.
R. R. Brickwood and H. B. Perkins, addresses not stated.
Qual. of dirs., £1.
Sub.: E. G. Parsons, 12, Blenheim Avenue, Southampton.

London Gazette Information

Voluntary Liquidations.

(Note.—Voluntary liquidations may, in some instances, refer to companies in course of reconstruction.)

VITAMOGEN, LTD. Resolved, August 15th, that the company be wound up voluntarily, and that Mr. E. D. Bennett, of Briary Cottage, Crondall, Hampshire, be appointed liquidator.

THE PARKFIELD DAIRIES, LTD. Resolved, August 26th, that the company be wound up voluntarily, and that Mr. J. K. Burton, C.A., 1, Berridge Street, Leicester, and Mr. H. A. Gutteridge, Accountant, 45, Regent Street, Hinckley, be joint liquidators. Claims to Mr. J. K. Burton by October 12th.

Current Literature

Fruit and Vegetable Products

Oxidising Systems in Fruits. M. V. Cruess and W. Y. Fong. (*Fruit Prods. Jour.*, 1926, No. 3, 13.)

Vitamin—C Content of Fresh and Canned Pear. V. C. Craven and M. M. Kramer. (*Jour. Agric. Res.*, 1927, 34, 385.)

Discoloration of Canned Cranberries. F. W. Morse. (*Jour. Agric. Res.*, 1927, 34, 889.)

The Antiscorbutic Fraction of Lemon Juice, V., S. Zilva. (*Biochem. Jour.*, 1927, 21, 689.)

The Various Methods of Preparation of Apple Pulp. E. Jacobsen. (*Kons. Zeit.*, 1927, No. 37.)

Pectins. (*Kons. Zeit.*, 1927, No. 37.)

Methods of Preserving Pears. E. Jacobsen. (*Kons. Zeit.*, 1927, No. 36.)

Blending Apple Juice to Improve its Quality. J. S. Caldwell. (*Fruit Prods. Jour.*, 1927, August.)

Grape Juice and its Preparation. R. O. Brooks. (*Fruit Prods. Jour.*, 1927, August.)

Researches on the Cold Storage of Fruit and Vegetables. R. Plank. (Bulletin No. 2, 1927, *Mitteilung aus dem Kältetechnischen Institut Hochschule Karlsruhe.*)

New Uses of Fruit Pectin. W. A. Rooker. (*Fruit Prods. Jour.*, 1927, September.)

Various Grape and Wine Products. H. F. Stoll. (*Fruit Prods. Jour.*, 1927, September.)

Cereal Products

Acidity of Wheat and Flour. H. L. Thompson. (*Amer. Miller*, 1927, 55, 160.)

Durum Wheats. H. Vogel and C. H. Bailey. (*Cereal Chem.*, 1927, 4, 136.)

Ash of Hard Spring Wheat and its Products. B. Sullivan and C. Near. (*Ind. Eng. Chem.*, 1927, 19, [illegible].)

Rate of Drying of Wheat Flour, Starch, and Gluten. E. A. Fisher. (*Cereal Chem.*, 1927, 4, 184.)

Use of Ostwald Viscosimeters for Flour Suspensions. H. J. Denham, G. W. S. Blair, and G. Watts (*Cereal Chem.*, 1927, 4, 206.)

Various

Reversed Potentials in the Corrosion of Tin-plate. C. L. Mantell and W. G. King. (*Amer. Electrochem. Soc.*, April, 1927, 51.)

The Water Content of Coffee and Coffee Substitutes. K. Lendrich. (*Deut. Nahrungsm-Runds.*, 1927, Nos. 17 and 18.)

Micro-Organisms in Chemical Industry, II. (*a*).—Food Preparation and Preservation. G. M. Dyson. (*Chem. Age*, 1927, No. 424, 146).

Recent Researches on the Preserving of Flesh by the Ottesen Method. E. Oestert. (Bulletin No. 1, 1927, *Mitteilung aus dem Kältetechnischen Institut Hochschule Karlsruhe.*)

Why some Tin-plates Fail. H. S. Thomas (*Packing Gazette*, 1927, No. 27, 113.)

How to Plan a Lighting System for Your Cannery. K. S. Ritchie. (*Canning Age*, September, 1927, 743.)

A Simple Method of Detecting Faulty Can Seams. D. M. Stevens. (*Canning Age*, September, 1927, 750.)

Heat Transmission in Glass Packed Products. D. M. Gray. (*Canning Age*, September, 1927, 765.)

Variations in the Susceptibility of the Fat in Dry Whole Milks to Oxidation. G. E. Holm, P. A. Wright, and G. R. Greenbank. (*Jour. Dairy Sci.*, 1927, 10, 33.)

Analysis

Determination of Glutenin in Wheat Flour. M. J. Blish, R. C. Abbott, and H. Platenius (*Cereal Chem.*, 1927, 4, 129.)

Determination of Starch in Potatoes. G. Rankoff. (*Zeit. Unters. Lebens.*, 1927, 53, 138.)

Proteins: I. Amino-acids of Soya Bean Meal. II. Amino-acids of Herring Meal. K. Shita and T. Yanagigawa. (*Rep. Imp. Ind. Res. Inst., Osaka*, 1926, 7 [9], 1.)

Determination of Casein in Milk by an Approximately Iso-Electric Precipitation. H. C. Waterman. (*Jour. Assoc. Off. Agric. Chem.*, 1927, 10, 259.)

(*Continued from previous page.*)

THE MIDHURST EGG CO., LTD. Resolved, September 12th, that the company be wound up voluntarily, and that Mr. W. Johnstone, of Bybrook, Midhurst, Sussex, be appointed liquidator.

THE ST. ALBANS MINERAL WATER CO., LTD. Resolved, September 5th, that the company be wound up voluntarily, and that Mr. G. W. Baker, 12, London Road, St. Albans, be appointed liquidator. All creditors have been, or will be, paid in full.

Companies Acts.
Intended Dividend.

ALEXANDER STEWART AND SON OF DUNDEE, LTD., 31, Lombard Street, E.C. (00121 of 1924). Last day for receiving proofs, October 5th, 1927. Liquidator, J. E. McIntyre, 29, Commercial Street, Dundee.

Notice of Dividend.

THANET CONFECTIONS, LTD., Station Gates, High Street, Broadstairs. (2 of 1925). First and final dividend of 5s. 10½d. per £, payable September 12th, 1927, at 39, St. Margaret's Street, Canterbury.

Appointment of Liquidators.

THE CITY OF CHICAGO BREWING AND MALTING CO., LTD., 121, Victoria Street, S.W. (00184 of 1927). Liquidator, E. Hart (with a Committee of Inspection). 9 and 10, King Street, E.C.2. Appointment, August 26th, 1927.

Recent Patents

The following abstracts are obtained from recently published copies of the "Illustrated Official Journal" (Patents) by permission of the Controller of H.M. Stationery Office. Printed copies of full Patent Specifications accepted may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, at 1s. each.

273,356. **Biscuit machines.** T. AND T. VICARS, LTD., AND E. M. CROSLAND. February 1, 1926.

Sheet-cutting machines, stream-cutting machines, depositing machines.—In biscuit-cutting or forming machines wherein the biscuits are deposited upon pans, in order to change the number of biscuits per pan without changing the speed of the machine as a whole, the cutting or forming mechanism is driven through variable-speed gearing from a driving shaft independently of the dough feeding-means, pan conveyer, etc.

273,400. **Coating confectionery.** BAKER, PERKINS, LTD., AND G. R. BAKER, J. W. EPPS, G. W. PERKS, AND SOC. ANON. DES ANCIENS ETABLISSEMENTS A. SAVY, JEANJEAN, ET CIE. March 31, 1926.

Confectionery is coated by depositing thereon a coating substance, one portion of which, forming the outside of the coating, is in a "grained" or partly crystallised condition, the graining of the outside layer being effected by lowering its temperature.

273,578. **Jams, jellies, etc.** D. MCKINLAY. December 14, 1926.

In the manufacture of preserves such as jams and jellies, the ingredients are treated with artificially produced ultra-violet rays, whilst being heated in a vessel, for the purpose of sterilising the ingredients and increasing the food value of the preserve.

273,857. **Bottle-filling machines.** S. HUTCHIN. May 10, 1926.

Relates to bottling machines of the rotary, suction or vacuum type, and consists in means for controlling the flow of the liquid to bottles comprising a filling valve and an interceptor.

273,861. **Ovens for baking, drying, etc.** T. AND T. VICARS, LTD., AND E. M. CROSSLAND. January 4, 1926.

273,971. **Dough dividing.** F. H. ROGERS. January 10, 1927.

274,051. **Vegetable food preparations.** E. H. MILES AND G. REILLY. June 17, 1927. (Not yet accepted.)

An alimentary vegetable preparation is made by mixing the juice of dietetic vegetable material—*e.g.*, lettuce, cabbage, etc., with that of preservative vegetable material—*e.g.*, carrots, parsnips, beets—heating till hydrolisation of the sucrose is well advanced, and then concentrating, the heating being prolonged not more than about one hour at a temperature not exceeding about 80° C. Pieces of vegetable material may be added to the juice before concentration.

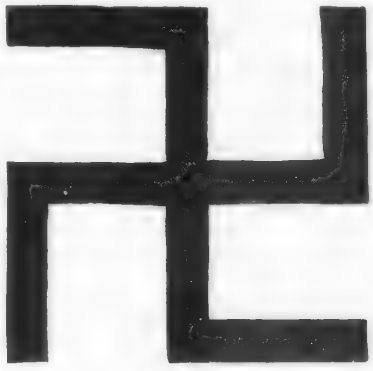
274,164. **Preserving food.** C. T. J. VAUTIN AND W. G. WHIFFEN. April 6, 1926.

Substances such as milk, cream, butter, margarine, eggs, fish, meat, fruit preserves, etc., are preserved by interposing between their otherwise exposed surfaces and the surrounding atmosphere an alkaline earth iodate, preferably calcium iodate, in the form of a powder, for dusting on, or of an aqueous solution. Solid substances may be built in layers with fabric or other porous sheets impregnated with iodate solution between and covered with a porous cloth or pad kept moist with iodate solution—*e.g.*, by wicks dipping therein. Liquids such as milk or cream may be covered with a felt, cotton-wool, or other absorbent pad, etc., soaked in the solution, with a sheet of toughened filter paper, also soaked in the solution, between. The materials may also be immersed in the solution. The solutions employed are preferably saturated. Sodium chloride may be added to the iodate in order to obtain more concentrated solutions, more especially for the treatment of fish and other readily putrescible materials. Specifications 6304/84 and 17070/08 are referred to. The Provisional Specification describes the preservation of milk, cream, and butter by admixture of calcium iodate therewith.

274,200. **Preserving natural products, etc.** S. FOWLER AND E. EDSER. April 16, 1926.

Eggs are preserved by applying, at atmospheric pressure, a neutral non-putrefying wax in the form of a thin liquid which can enter and coat the walls of the pores. The wax prevents water leaving the egg by increasing the contact angle between the water and the walls of those pores which have not been completely filled with wax. The liquid preferably consists of a solution of wool-fat or other cholesterol-containing wax in trichlorethylene or other volatile solvent which renders it non-inflammable, and may be prepared as described in Specification 163,474. The wool-fat may be prepared as described in Specification 253,995.

274,353. **Dough-working machines.** F. H. ROGERS. January 10, 1927.



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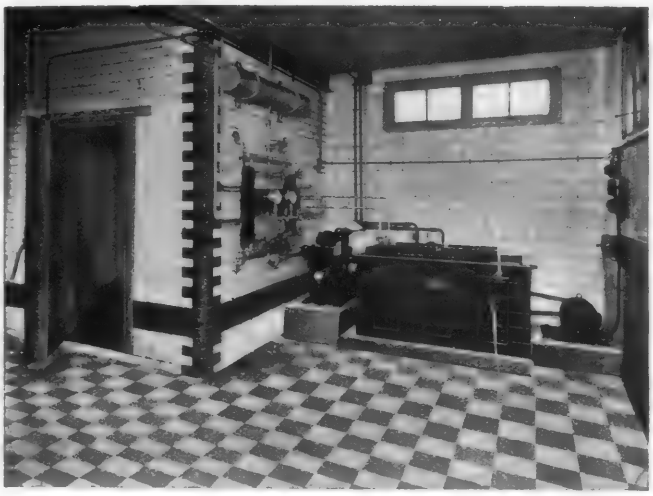

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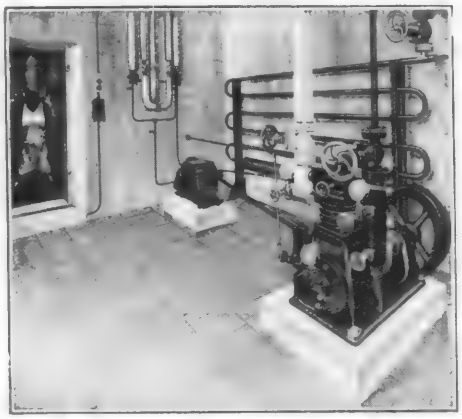

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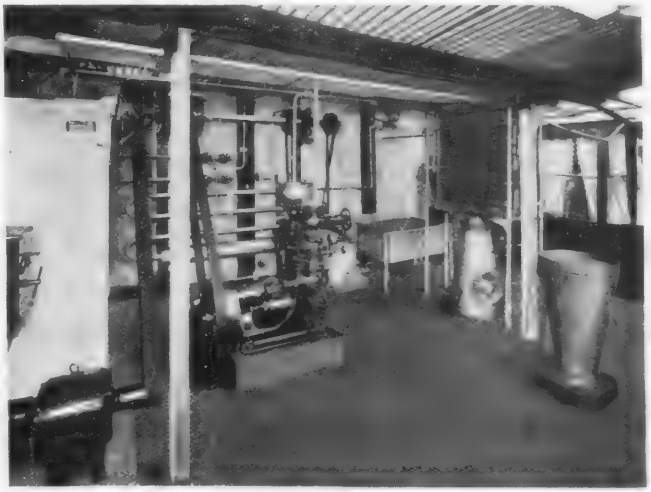

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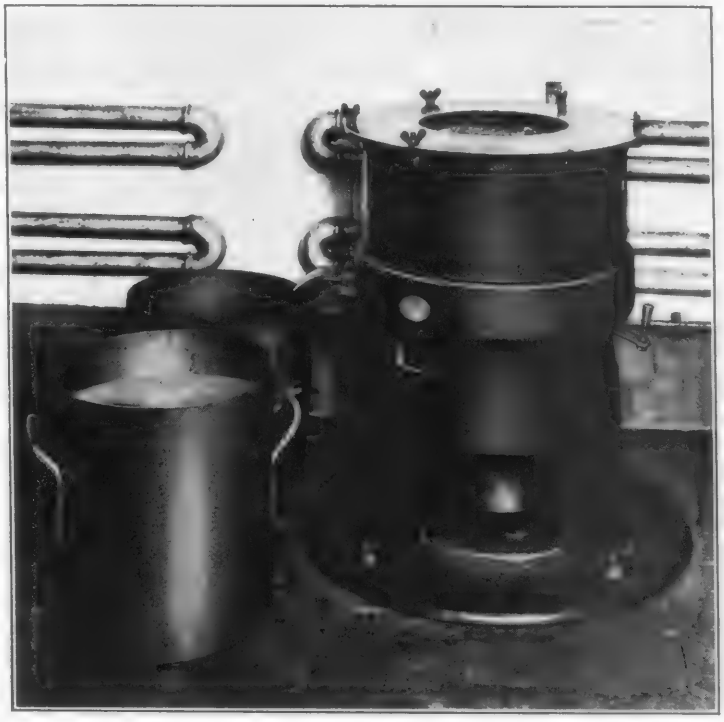

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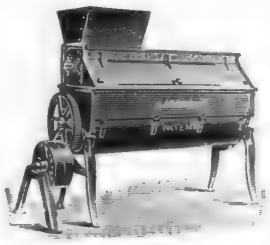

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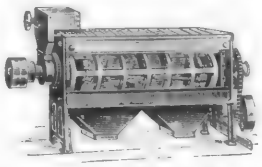
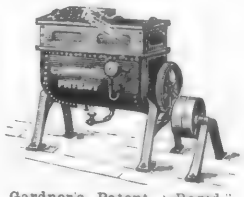


Gardner's Patent Quick Change Dresser, with Removable Barrel for sifting Coarse or Finest Grades.



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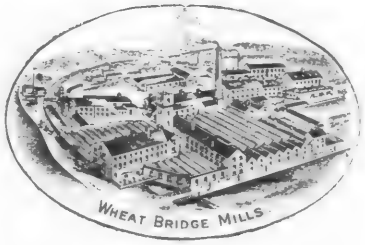

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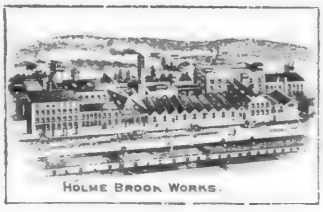

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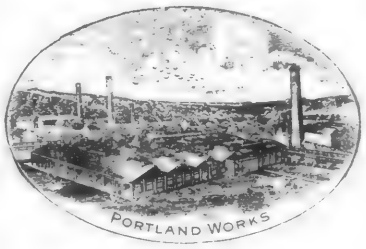
We have been manufacturing this class of box now for close on a century, and our accumulated experience is at your disposal. Advice in your packing troubles and samples entirely free. Let us help you.



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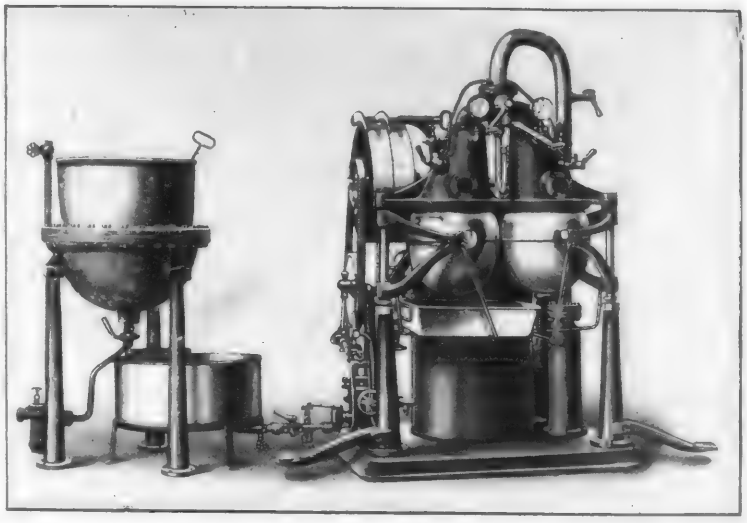

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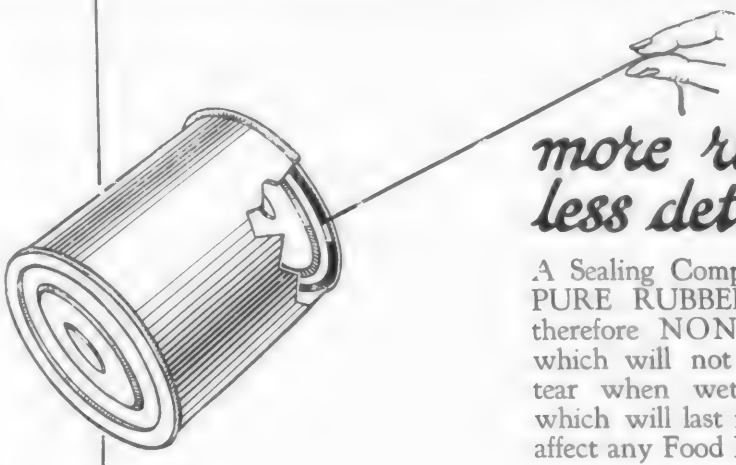

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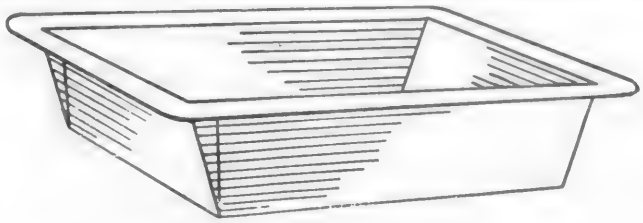

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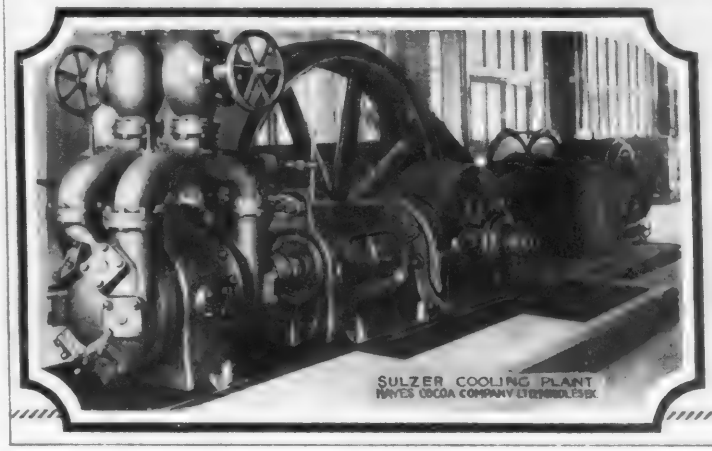
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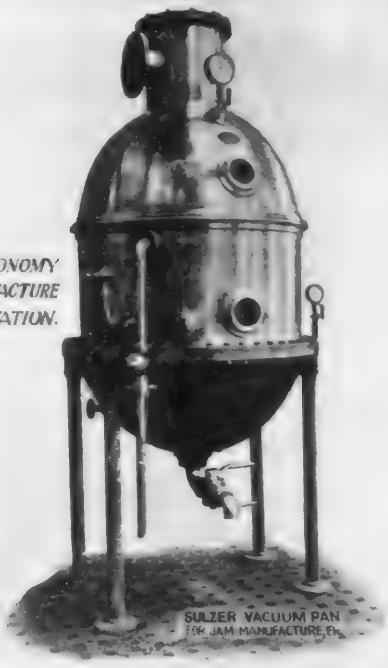
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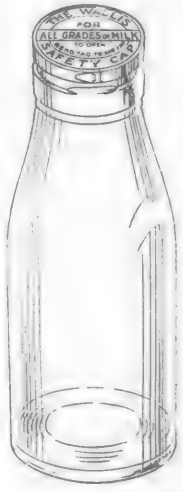

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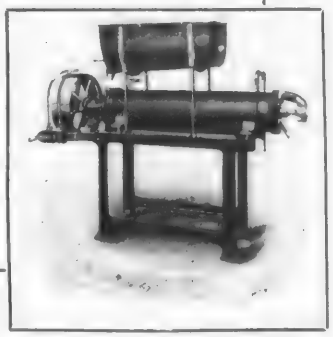

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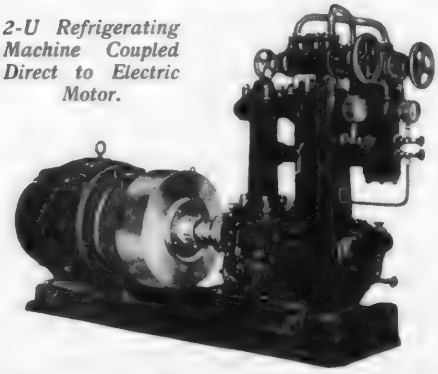

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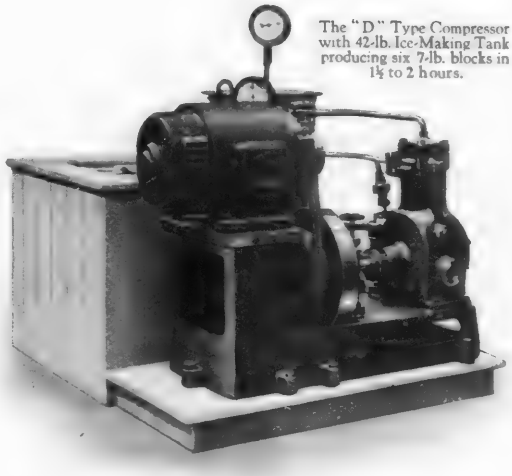

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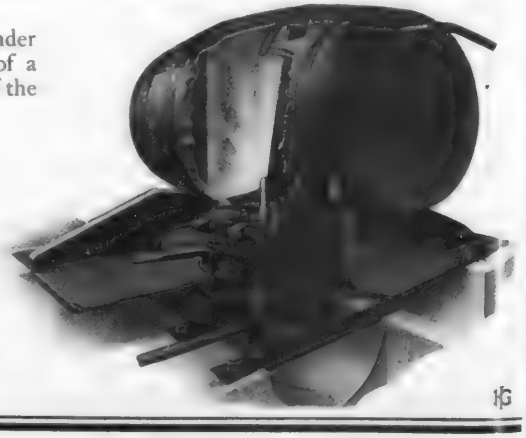

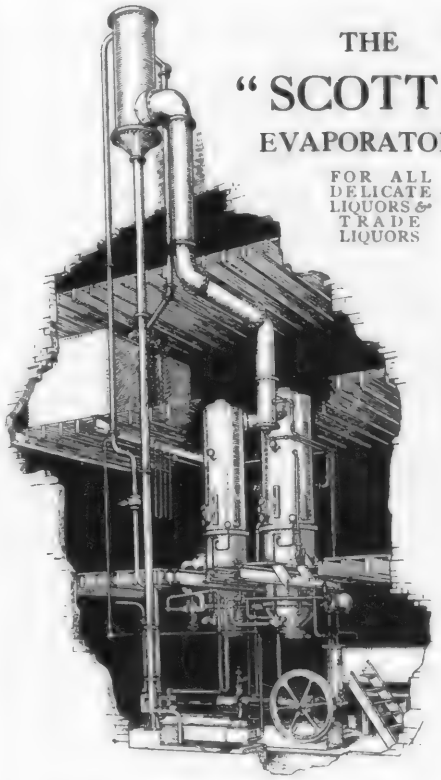

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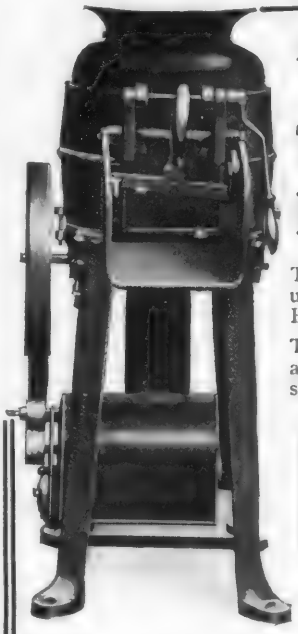

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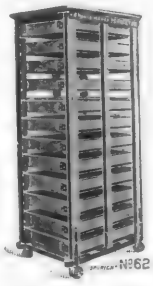

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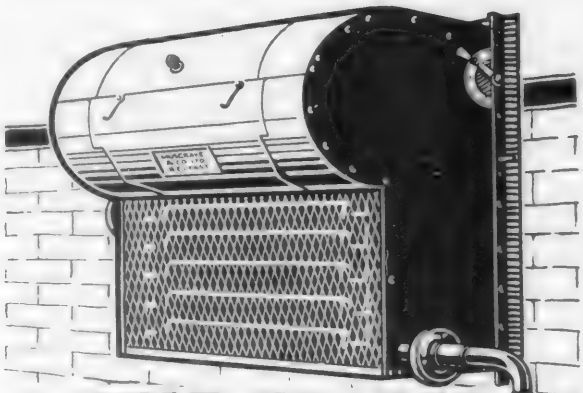

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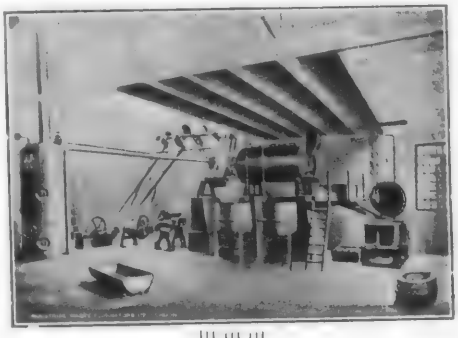

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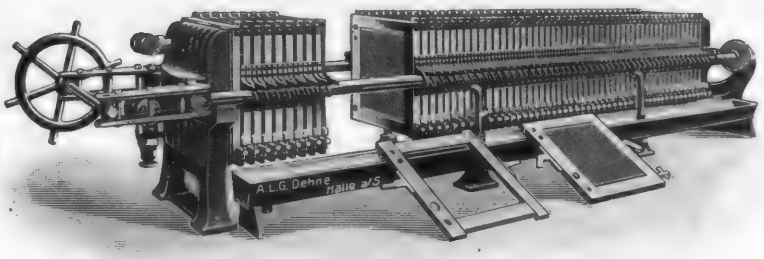

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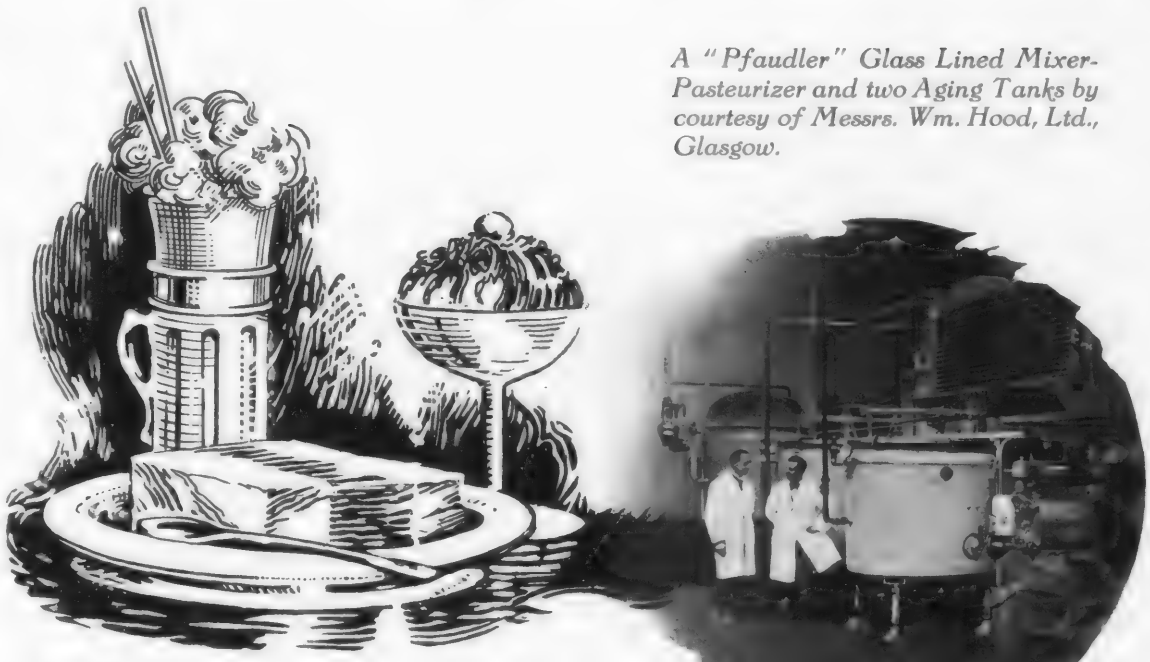

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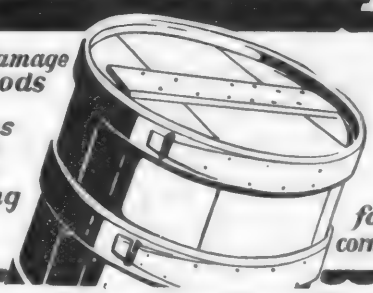

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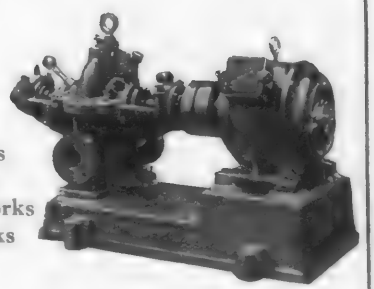

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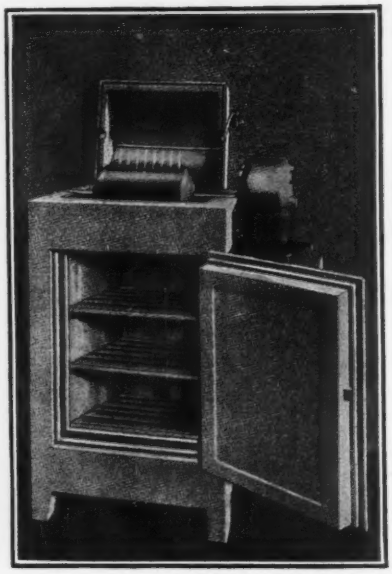

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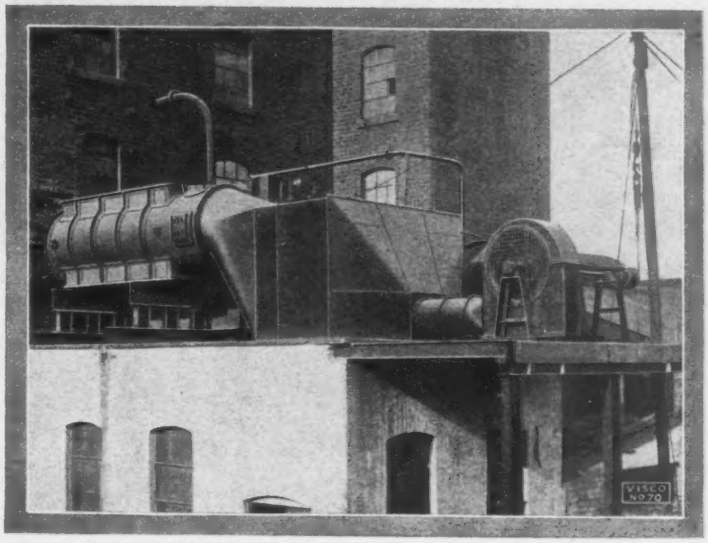

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